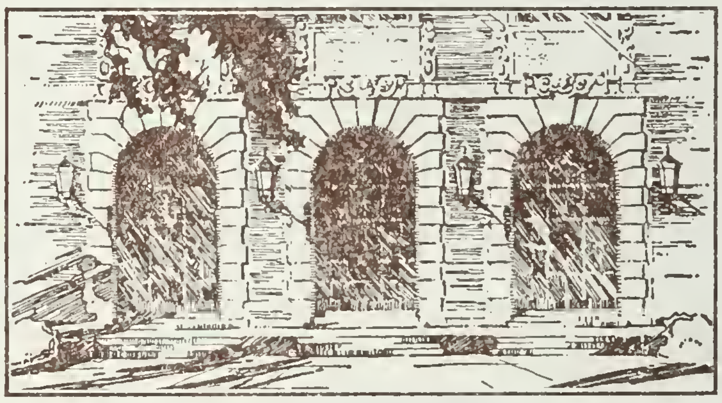
This book has been DIGITIZED
and is available ONLINE.

LIBRARY OF THE
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

595.7
Il6
v. 8

SEP 9 1976



BIOLOGY

OAK ST. HDSF

[illegible]

ARY U. OF I. URBANA-CHAMPAIGN

RARY U OF I URBANA-CHAMPAIGN

EIGHTH REPORT

OF THE

STATE ENTOMOLOGIST

(WALSH, 1. LE BARON, 4. THOMAS, 3.)

ON THE

NOXIOUS AND BENEFICIAL INSECTS

OF THE

STATE OF ILLINOIS.

THIRD ANNUAL REPORT

BY CYRUS THOMAS, PH. D.,

STATE ENTOMOLOGIST.

SPRINGFIELD:
WEBER & CO., STATE PRINTERS,
1879.

BIOLOGY

LIBRARY OF
Illinois State
Laboratory of Natural History
NORMAL, ILLINOIS.
Pantagraph, Bloomington, Ill.

595.7
Il6
v. 8

TABLE OF CONTENTS.

PAGE.
Letter of Transmittal ... 1
Introduction ... 5
Classification ... 9-142
Order Hemiptera, Sub-order Heteroptera ... 9
Homoptera, 9. Subdivisions of Homoptera ... 10
Synopsis of the families of Plant-lice ... 10
Key to Hemiptera ... 11
Psyllidae—Jumping Plant-lice. (Fam.) ... 12
Genus Diraphia ... 13
Psylla ... 15
Aphididæ—Family ... 19
Nomenclature ... 19
Characteristics of the Family ... 26
Life-history and Habits ... 27
Classification ... 33
Synoptical table of the Sub-families and Genera ... 39
Description of Species ... 44
Sub-family Aphidinæ ... 46
Sec Siphonophorini ... 46
Genus Siphonophora ... 46
Phorodon ... 69
Megoura ... 73
Myzus ... 74
Drepanosiphum ... 78
Rhopalosiphum ... 79
Hyalopterus ... 82
Sec. Aphidini ... 83
Genus Siphocoryne ... 83
Aphis ... 84
Chaitophorus ... 103
Myzocallis ... 105
Callipterus ... 109
Sec. Lachnini ... 114
Genus Lachnus ... 115
Phyllaphis ... 120
Sipha ... 120
Sub-family Pemphiginæ ... 122
Sec. Schizoneurini ... 125
Genus Schizoneura ... 125
Glyphina ... 142
Vacuna ... 145
Sec. Pemphigini ... 145
Genus Pemphigus ... 146
Sub-family Chermesinæ ... 155
Genus Chermes ... 155
Phylloxera ... 157
Sub-family Rhizobinæ ... 164
Genus Rhizobius ... 165
Tychea ... 167
Species of uncertain position ... 170
Insect Enemies and Parasites ... 172
Artificial means of destruction ... 179
Remarks ... 181
Supplement ... 186
Psyllidæ—Brief Synopsis of the Genera ... 211

734704

LIST OF ILLUSTRATIONS.

PAGE.

Fig. 1. Heteropterous insect 3
2. Psylla pyri 19
3. Wings of Siphonophora—illustrating the nomenclature 25
4. Wing of Aphis mali 25
5. Wings of Schizoneura 25
6. Wings of Tetraneura 25
7. Wings of Chermes 25
8. Apterous Plant-louse 26
9. Wings of Aphis mali 44
10. Wings of Schizoneura 44
11 Siphonophora acerifoliæ 47
12. ‘‘ coreopsidis—Winged individual 59
13. ‘‘ ‘‘ Wingless individual 60
14. ‘‘ ‘‘ ‘‘ 60
15. Wings of Aphis mali 85
16. Aphis mali—Wingless individual 85
17. (Erroneously numbered 14) Aphides 89

No. 1. Aphis maidis—Winged insect.
2. Head and antennæ of Aphis mali.
3. Aphis maidis—Winged female.
4. Corn root infested by Aphis maidis.
5. Glyphina ulmicola—Wings.
6. Pemphigus poulicaulis—Wings.
7. Head of Pemphigus.
8. Wings of Phylloxera.

18. Lachnus dentatus 116
19. Apple root Plant-louse 126
20. Root-louse Syrphus-fly 131
21. Glyphina ulmicola (Elm-leaf Cocks-comb—Gall Aphis) 143
22. Elm leaf Cocks-comb gall 143
23. Omitted ..
24. Wings of Tetraneura ulmi 146
25. Pemphigus vagabundus 146
26. Poplar-leaf Gall-louse 148
27. Gall of Pemphigus vagabundus 152
28. Gall of Pemphigus rhois 153
29. Wings of Chermes laricis 155
30. Adelges of the Spruce 157
31. Tychea panici (omitted) ..
32. Lady-bird larva 173
33. The Spotted Lady-bird 173
34. The Convergent Lady-bird, Larva and Pupa 173
35. The 13-spotted Lady-bird 174
36. The 9-spotted Lady bird 174
37. The Trim Lady-bird 174
38. The Twice-stabbed Lady-bird 174
39. The Twice-stabbed Lady-bird larva 174
40. Chrysopa-eggs, larva, cocoon and perfect insect 177
41. Syrphus fly 178
42. Larva of Syrphus-fly 179
43. ‘‘ ‘‘ feeding on a Plant-louse 178
44. Schizoneura americana 202
45. Pemphigus populi-monilis 205
49, Hormaphis spinosus 207
47. Pemphigus populi-transversus 208

LETTER OF TRANSMITTAL.

CARBONDALE, ILL., Dec. 30, 1878.

Hon. D. B. Gillham, President of the State Board of Agriculture:

DEAR SIR:—In presenting to you this, my third "Report as State Entomologist on the Noxious and Beneficial Insects of the State of Illinois," I trust I may be excused for offering some explanations for adopting in this case a somewhat more strictly scientific plan than in my previous report. Not that the language used is any more difficult for unscientific readers to understand, or more technical, for I have endeavored in the preparation of this, as well as of my previous reports, to keep constantly before my mind the fact that my work was chiefly for the benefit of the farmers and horticulturists of Illinois. But at the same time I have felt that there were others of our state interested in this matter, and not a small number either, whose benefit it was also my duty to consider in preparing this report.

The addition, by the school law of our state, of the natural history branches to the studies in our common schools has compelled teachers, many of whom would perhaps otherwise pass these branches by with little notice, to give sufficient attention to them at least to pass examinations in them for first grade certificates. The result has been just what it was expected it would be by those who have given attention to these branches of knowledge, viz: that as soon as they entered upon this new field of knowledge a large portion would become interested therein.

An interest in natural history has been awakened in the minds of teachers and students all over the state to an extent scarcely anticipated by the most sanguine. As insects are most easily procured and most readily preserved, this particular department of the science of zoology has received a very large share of attention. As it is as easy to illustrate the principles of classification, the methods of distinguishing objects and arranging them, by insects as by the larger animals which are more difficult to procure, and the preparation and preservation of which is much more expensive, teachers have found these small animals a ready means of illustrating the principles of the science. Another advantage gained by using them arises from what might at first appear to be an objection—their small size, viz: the necessity for close observations.

This has largely increased the demand for these reports, and other works on this particular science. I have therefore made it a point to meet this demand as far as possible without sacrificing usefulness in the direction for which the labors of an entomologist were originally intended. Nor has this been done solely for this purpose, but because in this way the number to be reached by these reports would be largely increased.

I may also be permitted to state here another fact of which your board is fully aware, and which you appreciate as fully as I do, that agriculture itself is a science as well as an industry, and I may add the most useful of all sciences and the most important of all industries. There is scarcely an operation in the whole round of agricultural pursuits but what is based upon scientific principles, and very largely upon natural science. Botany, zoology, meteorology, geology, chemistry and the wide scope of natural philosophy, are all called upon to contribute their aid in rendering it more and more successful. Not that crops can be raised, stock improved, and horticulture rendered profitable by scientific theories alone, or by the simple reading of scientific treatises, but by the practical application of true scientific principles. The scientist studies out the laws and principles of nature, the agriculturist makes the practical application, and thus renders them useful, and thus they become co-workers in the effort to benefit mankind, Your board stands as the head and representative of the great agricultural interests of our state, which is pr-eeminently an agricultural state. That you may fulfill to the best advantage the important trust imposed upon you, it is proper, in fact due to your position, that you should have all possible aid given to you. This important fact I regret to say has not always been as fully appreciated as it ought to be by our legislatures. But this has not arisen so much from an unwillingness to legislate in behalf of our agricultural interests as from two other causes—first the fascination which the great problems of political government and control have over the minds of men when they have once entered into the discussion of them; and, second, from the fact the agriculturists themselves have too often failed to present their legislators properly matured plans, by which their great industry might be materially benefitted. I am inclined to think that the latter has probably been as often the cause of neglect as the first.

It is not my province, nor is this the proper place to enter into a discussion of this subject, and I only allude to it here so far as it bears upon the question of bringing to your aid the scientific knowledge which may assist you in fulfilling to the best possible degree for the advancement of the agricultural interests of our state, the duties imposed upon your board.

I am exceedingly gratified at the step your board has taken on this subject; it is a step in the proper direction, and which, if you are properly supported in it, and enabled to carry out, must result in materially benefitting the agricultural interests of our state.

Although my time and studies have been largely devoted to the particular branch of science in which I am at present employed, yet the question, "What can be done to elevate agriculture as a science, and to benefit the great industry of our state?" is one that has long deeply interested me; and one with which I am constantly coming in contact since I entered upon my duties as state entomologist. Every new fact ascertained in reference to the production of any useful crop, or the culture of a plant, has more or less bearing upon the subject of economic entomology. And the same is true in reference to every new feature in farming or horticulture. Each year, as I close my report, and deliver it for publication, I feel more and more impressed with the necessity of being more practical. I have, therefore, felt it necessary in this case to explain why my report has been devoted chiefly to a limited group of insects, and for the scientific treatment of the subject.

As before intimated, one object has been to spread before the people of our state as rapidly as possible the means of obtaining a general knowledge of the science of entomology, and to this end I have devoted a part of each report to a manual of economic entomology. In the first this part was devoted to the *Coleoptera*, or beetles, found to be injurious in our state; in the second report it was devoted to the *Lepidoptera*, or butterflies and moths, whose caterpillars are found to be more or less injurious. The present report is devoted chiefly to the history, habits and description of the various species of plant-lice found in our country, all of which are injurious to plants. As but little attention has heretofore been paid to these insects by the entomologists of our country, I had to depend very largely upon my own observations, describing for the first time a large number of the species mentioned.

As this family presents some of the most singular characteristics of the entire class, and requires a somewhat peculiar nomenclature, it was necessary that I should devote considerable space to the discussion and explanation of these points. I have also endeavored in this part of my reports to so treat the groups taken up that it would not be necessary to go over them again, but to make them, when taken together, a manual for reference hereafter.

At the close of the report will be found, notes of the year, and mention of special insects found injurious during the past season in our state.

Allow me, through you, to thank the board for the honor they have conferred upon me, by selecting me as Entomologist. It was especially gratifying as it indicated that my labors as State Entomologist had at least been satisfactory. I shall be pleased at any time to have the board direct me as to particular investigations they desire made in my department, as I will thus have my attention called more particularly to what is considered most important.

It was recently suggested to me by a member of the board that it might be well to study anew the comparatively few species which Dr. LeBaron aptly designated "first class," as injurious insects. The suggestion I think is a good one, and as it coincides with the plan I have had in view for the past two years, I propose to devote my attention chiefly to it during the next year.

This is a work which cannot be finished in a single season, but requires time and favorable opportunities in order to obtain satisfactory results.

I wish here to tender my thanks to the Governor and various state officers, yourself, Secretary Fisher and the board, for favors received, and the evident sympathy they have shown at all times with my work. I am also under obligations to the Illinois Central and Chicago & Northwestern railroads for passes when on duty as entomologist, and especially to J. F. Tucker, Esq., manager of the former, who has always been ready to aid me in my work whenever he could do so, by granting facilities for visiting different sections of the state.

I remain yours, very respectfully,

CYRUS THOMAS.

INTRODUCTION.

There is scarcely an individual, old or young, who has paid any attention to plants during the summer, that has not observed upon the eaves or stems, twigs or bark, certain minute, soft-bodied insects, usually without wings and generally huddled together in little groups busily engaged in pumping the sap of the plant on which they are stationed. These insects, on account of their resemblance to certain other insects, and their parasitic habits have, by common consent, received the very appropriate popular name PLANT-LICE. Scarcely a plant in the vegetable or flower garden; a bush, tree or vine in the yard, orchard, nursery, grove or forest; a worthless weed or variety of grass, but what at some time appears to be infested by them. Leaves, flower-stalks, twigs, stems and even the roots are at some time compelled to furnish these insects food. Yet, notwithstanding their very general distribution and constant presence during the summer in almost every garden, yard, orchard and grove, but comparatively little attention appears to have been paid to them in this country. Even our entomologists appear to have generally passed them by with but little notice, and although it is probable our species will ultimately be numbered by the hundreds, yet up to within the last two or three years scarcely a score had been described and named. One reason for his neglect probably arises from the fact of the difficulty of preserving species for subsequent examination, and that but few systematic works on the family had appeared in Europe.

One reason why so little notice has been paid to them in works on economic entomology, is probably because of the supposition of their great similarity in habits, and that a remedy applicable to one species would be equally applicable to all the others. But what has been found to be true in reference to other groups of insects is to a certain extent at least true of these, that the more carefully we study them, and the more we find out in reference o their history and habits, the better qualified are we to counteract and control them, and the more effectual will be the remedies which we will be able to suggest.

In order to illustrate the correctness of these remarks we have only o refer to the investigations in reference to a single species, the Grape Phylloxera, (*Phylloxera vitifoliæ* Fitch.) which engaged the attenion of some of the ablest entomologists both of Europe and America everal years before its life history was thoroughly ascertained. My tudy of our Aphides for a few years, has sufficed to convice me that as yet we are but upon the threshold of their biological history, that what has been ascertained in reference to them is but a small fraction of that which is yet to be learned.

Some of the grandest problems that relate to animal life, belong to the study of these little animated grains, and if ever solved, will, in all probability, be solved by carefully studying their life history.

As they stand, to a great extent, isolated, even in the order of insects to which they belong, it is necessary, in order to understand the characters by which they are classified and described, to adopt a somewhat peculiar system of nomenclature for the group. In order therefore to render this synopsis as complete as possible within the limits to which it is restricted, it is necessary to give at least a brief account of this system and an explanation of the terms used which are peculiarly applicable here, or which are used in a different sense from that in which they are generally applied in entomology.

In an economic point of view, their importance is undoubtedly greater than generally supposed. Their small size causes them to be overlooked to a far greater extent than those who are acquainted with them are willing to believe. I have been astonished since I commenced to study them carefully, to find very many old and experienced agriculturists who are wholly unacquainted with them by their common name, Plant-Lice.

Their quiet and silent method of operating, drawing so gradually upon the vitality of the plant, is another reason why attention is not more frequently drawn to them. It is, therefore, only when they develop in immense numbers on some important cultivated plant, as wheat, hops, etc., that any particular notice is paid to them.

The appearance of the grain plant louse, (*Siphonophora granaria*,) last summer, upon the wheat in the southern part of the state, excited universal alarm—few farmers being able to determine the character of the insect—some supposing it to be the chinch-bug and others the Hessian-fly, although aware from an inspection of them that they differed in some respects from either of these species.

These facts, together with the fact of their capability of increase with a rapidity, perhaps unequaled in the entire insect class, render them of sufficient importance to receive the notice here given, in a work on economic entomology. It is proper to state here that the terms *Aphididae* and Plant-lice, in the title of this work, are used in the broad sense, including the leaping plant-lice as well as the true aphides; further on, when the distinction is shown, these terms will be restricted to their proper groups.

On account of their general similarity in appearance and habits, ordinary observers have been content with simply designating them by their common name. They somewhat closely resemble each other in general appearance, as well as in the habit of subsisting upon the juices of the plants on which they reside, it is true; but when we come to examine them closely and compare them carefully one with another, we find there are marked differences in the details of their external anatomy as well as their habits, showing not only that there is a vast number of different species, but also that the species readily admit of being aggregated or arranged into groups by common characters; or, in other words, that there are generic and family differences, as well as specific differences among them.

For example: A number of species possess the power of leaping, most of which have the antennæ terminated by two minute bristles, in both of which respects they differ from all the other species; some are always found more or less covered with a whitish, cottony or downy substance, while others are always naked; some possess little horn-like appendages, called "honey tubes," arising from the upper part of the abdomen near the tip, while others are entirely without these; some have the very singular habit of bringing forth their young alive, while others are always oviparous; some confine their operations exclusively to the leaves, others to the twigs and bark, and others to the roots, while others operate both on the stem and root or leaves and roots; some reside exposed on the surface of the leaves or bark, while others, by some peculiar power, not yet understood, form galls in which they carry on their operations and pass the greater portion of their existence; in most cases the pupae are active as the perfect insects, yet there are some species in which these are stationary, and resemble the apparently lifeless scale of the bark-life.

Most of the species, at some period of the year, present winged individuals of one or both sexes, yet their habits in this respect are widely different, and the differences between the wings of the various species afford some of the best characters yet observed for separating them into generic or larger groups.

For example: In a very large portion, in fact in most of our American species, the wings are very thin and membranous and almost perfectly transparent, while in one very singular group they are opaque and more or less covered with a fine powder, giving them the appearance of minute moths. Very marked differences are found in the veining of the transparent wings of the former; in some the rib-vein or chief vein of the fore-wings is central; and as it proceeds towards the apex divides into branches, each of which is again divided; while in another very large group the rib-vein coasts along near the front margin, giving off on the posterior or inner side three bunches which run obliquely outward and backward to the hind margin; some have the third or outer branch twice forked, others once, while in others it is simple or unbranched. Some species place their wings, when in repose, against each other, above the back, in the form of a very steep roof, while others rest them horizontally on the abdomen. Some have the antennae as long or even longer than the body, while in others these organs do not reach the middle of the thorax; these organs, when tipped with two bristles are nine or ten (usually ten) jointed, in all other cases they are seven or less than seven-jointed, in many species they are six-jointed, in quite a number five-jointed and in one generic group but three-jointed.

Some of these differences will doubtless be considered unworthy of notice by those who have never devoted any time to the study of insects and their characters; but when it is found by close and persistent study of the habits of these insects that the difference in the number of forks of one of the branch or discoidal veins is always accompanied by a marked difference in habits, this character, although apparently insignificant, is really important. A knowledge of these facts enables the entomologist, if he can see but a single tiny forewing, to tell at once to what group the species belongs and what are its habits.

Notwithstanding these differences between the groups and species, there are certain points in which all agree, the more important of which are as follows :

1st. In having the mouth formed for sucking, by being prolonged into a slender, horny, jointed tube, which arises far back under the breast, apparently between the front and middle legs.

2d. In not undergoing a complete transformation, as do the beetles, butterflies, etc.; the larvæ and pupæ being similar in form to the perfect insect.

3d. In having but two joints in the tarsi or feet.

4th. In having the antennæ longer than the head, and composed of filiform joints.

5th. In the fact that the winged individuals always have four wings.

6th. In the fact that all live upon the juices of plants.

7th. In their small size, no species of our country exceeding one-fourth of an inch in the length of the body, while many fall considerably short of one-tenth of an inch.

These characters, if particularly observed, will enable the student of entomology, or the agriculturalist who has any knowledge whatever of the science, or of insect habits and characters, to distinguish plant-lice from all other insects.

CLASSIFICATION.

In order to avoid the necessity of reference to other entomological works, and to assist as far as possible those who are not familiar with the divisions of the insect class into orders, families, etc., I will add here the characters of the order, sub-order, etc., to which these insects belong. By reference to my first report the position of this order in the class will be seen.

ORDER HEMIPTERA.

The insects of this order are distinguished from those of other orders by the following characteristics:

1st. By the mouth, which is formed for sucking by being prolonged nto a slender, horny, jointed tube, which is usually bent under the breast when not in use.

2d. By the fact that they do not undergo a complete transformation or change as do the beetles and butterflies (which are at first grubs or caterpillars, and then quiet chrysalids taking no food), the arvæ and pupæ being similar in form to the perfect insects, the later not quiescent, but active and taking food as the larvæ and perfect nsects.

These characters include a very large number of insects, many of which differ very widely from each other in several important respects. The *Order* has therefore been divided by certain prominent characters n two Sub-Orders (by some treated as Orders), as follows:

Sub-Order HETEROPTERA.—Wings, when present, four; the front air larger than the posterior pair; lapping over each other at the tips, he basal portion thickened and leathery, while the portion at the tip is thin and membranous. The body is usually flattened above, and the wings, when at rest, always lie flat upon the abdomen. The mouth or beak arises from the front of the lower part of the head. Fig. 1 shows an example of this sub-order; *a* is the beak enlarged; *b*, the insect. This sub-order contains the squash-bug, chinch-bug, bed-bug, tarnished plant-bug, water-measurers, water-boatmen, etc.

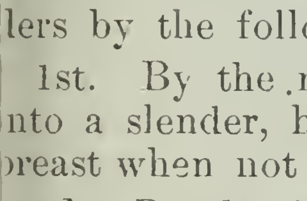


Fig. 1.

Sub-Order HOMOPTERA.—Wings, when present, four, (except in the ark-lice, where there are but two); the front pair usually slightly rger than the posterior pair; entirely membranous, sometimes slightly ickened, sometimes thin and transparent, but always similar in character throughout and not differing in character at the base from the p. When at rest (with few exceptions) the wings rest against each other, sloping like the sides of a roof; and do not over-lap. The mouth arises from the hinder part of the under surface of the head. This sub-order includes the cicadas or harvest-flies, the seventeen-year locusts, the tree-hoppers, leaf-hoppers, lantern-flies, plant-lice, bark-lice, etc.

It is divided by some entomologists into two sections, while others, as Westwood, divide it into three sections. These two plans are shown in the following brief, synoptical arrangement of the characters of these different sections.

Subdivisions of HOMOPTERA.

SECTION I.—Tarsi, or feet, three jointed; beak arising from the posterior portion of the under side of the head, but not apparently from the breast; wings present in the perfect insect in both sexes, and always four. This section contains all homopterous insects except plant and bark-lice, therefore further notice of it is omitted.

SECTION II.—Tarsi less than three jointed; beak arising apparently from the breast, between the front and middle legs; wings usually four when present, sometimes only two, often wanting in the females.

Division 1. Tarsi two-jointed; wings, when present, four; antennæ varying in length, but always longer than the head, from three to ten-jointed; never changing in the perfect state into an apparently lifeless scale; a distinct beak present in both sexes.

This division is named *Dimera* by Westwood, from the two-jointed tarsi, and contains the various kinds of plant-lice.

Division 2. Tarsi or feet one-jointed; wings present in the male only, and but two; the female changing, in the perfect state, into an apparently lifeless scale; the beak wanting in the perfect male.

This division is named *Monomera* by Westwood, from the one-jointed tarsi, and contains only the bark-lice or scale-insects.

The first of these "divisions," *Dimera*, which contains the plant-lice, is the only one we have to do with at present. It is divided into three families, *Psyllidæ*, *Aphididæ* and *Aleurodidæ*, which may be distinguished from each other by the characters given in the following brief synopsis:

Synopsis of the Families of Plant-lice.

A.—The four wings transparent, or at least thin and membranous, and not covered with a mealy or farinose substance; pupæ active and not scale like.

B.—Possessing the power of leaping; the antennæ thread-like, composed of nine or ten (usually ten) joints, and tipped at the end with two minute but distinct bristles. 1. Family—PSYLLIDÆ.

BB.—Not possessing the power of leaping; the antennæ usually six or seven-jointed, though sometimes only three or five-jointed, and always without the two bristles at the tip. 2. Family—APHIDIDÆ.

AA.—The four wings opaque, farinose, or covered with a powdery substance, resembling in general appearance minute moths; pupæ inactive and scale-like. 3. Family—ALEURODIDÆ.

The third family is placed by quite a number of entomologists among the *Coccidæ* or bark-lice, with which they agree in several important respects. It evidently forms an intermediate group between the two divisions, and approaches about as near to one as the other; practically it is of very little importance where it is placed, as there are no species belonging to the family that are sufficiently injurious to require attention.

By the most recent authorities as Buckton (*Monograph of British Aphides*) Packard, (*Guide to the Study of Insects*) etc., this group is placed among the *Coccidæ* or bark-lice. As I will have no occasion in the present brief account of our plant-lice, to allude to any species of it, I will not discuss its position.

The *Psyllidæ* are not usually included in works devoted to plant-lice, but as there are some species known to be injurious to cultivated plants, I have concluded to give a short account of the family and the few species which have been observed in this country.

The following is a copy of a "Key to Hemoptera" which I prepared for the use of my classes in entomology, and although perhaps not the best that could be devised, was nevertheless found quite useful in distinguishing the families of the order.

KEY TO HEMOPTERA.

(Families according to Westwood.) *(Sub-Orders.)*

I. Elytra uniform in texture, coriaceous or membranous: beak arising from the underside of the head........HOMOPTERA.
II. Elytra coriaceous at base; membranous at the apex; overlapping each other in repose; beak arising from the front of the head..... ...HETEROPTERA.

HOMOPTERA. *(Families.)*

a Tarsi three-jointed; antennæ minute, terminated by a slender bristle; wings areolate.
b Antennæ six or seven-jointed; three ocelli placed in a triangle on the back of the head; males musical...... ....*Cicadidae.*
bb Antennæ two or three-jointed, males not musical.
c Antennæ only distinctly three-jointed, inserted immediately beneath the eyes; the two ocelli placed beneath the eyes; head often rostrate ....*Fulgoridae.*
cc Antennæ apparently two-jointed, inserted in front between the eyes; head broad, triangular: the two ocelli placed on the face or forehead (sometimes wanting); pronotum sometimes enlarged; and anomalous in form........*Cercopidae.*
aa Tarsi two-jointed; antennæ six to ten-jointed, filiform, larger than the head; the four wings transparent; beak apparently arising from the prosternum.
d Antennæ ten-jointed, terminated by two short bristles, basal joint thick....*Psylidae.*
dd Antennæ three to seven-jointed, apex simple; abdomen with two, more or less, elongated tuburcles near the extremity. ....*Aphididæ.*
aaa Tarsi one-jointed, terminated by a single claw; males with but two wings and without beak; female apterous, changing to a footless scale on the plant it is attached to........*Coccidae.*

HETEROPTERA.

a Aquatic (residing in the water), posterior legs generally ciliated and fitted for swimming: antennæ very short, concealed in cavities beneath the eyes: tarsi rarely more than two jointed.

b Hind legs elongated, strongly ciliated; head nearly as wide as the body; antennæ four-jointed; anterior legs not raptorial, placed normally........ *Notonectidae.*

bb Hind legs not ciliated nor elongated; head small, much narrower than the thorax; anterior legs raptorial, placed well forward toward the head, like large antennæ, having one-jointed tarsi........ *Nepidae.*

aa Sub-aquatic (residing on the water or in damp places).

c Body flat and broadly oval, nearly circular, eyes pedunculated; anterior femora enlarged; tarsi one or two-jointed; beak short; antennæ short and concealed; residing in damp places........ *Galgulidae.*

cc Body long and narrow; antennæ somewhat long and slender, not concealed; anterior femora not enlarged; tarsi two or three jointed; eyes not pedunculated; residing on the water........ *Hydrometridae.*

aaa Terrestrial.

d Beak consisting of three joints, if four, the first is very short and annuliform.

e Beak naked, not received in a channel; head small, narrowed behind into a neck; body somewhat elongate; terminal joints of the antennæ slender........ *Reduviidae.*

ee Beak received in a channel; head not narrowed behind into a neck; body generally broadly oval: last joints of the antennæ not less than the preceding........ *Tingidae.*

dd Beak consisting of four distinct joints.

f Scutellum not reaching back to the middle of the abdomen.

g Antennæ four-jointed, inserted in or below an ideal line extending from the eyes to the base of the beak; membrane of the elytra never containing more than five veins.

h Terminal joints of the antennæ very slender, thinner than the preceding; ocelli never present; the coriaceous part of the elytra with a stigma-like triangular piece at the apex; membrane with only one or two strong veins........ *Capsidae.*

hh Terminal joints of the antennæ not thinner than the preceding, but not clubbed; ocelli sometimes present; elytra without the stigma-like piece........ *Lygeidae.*

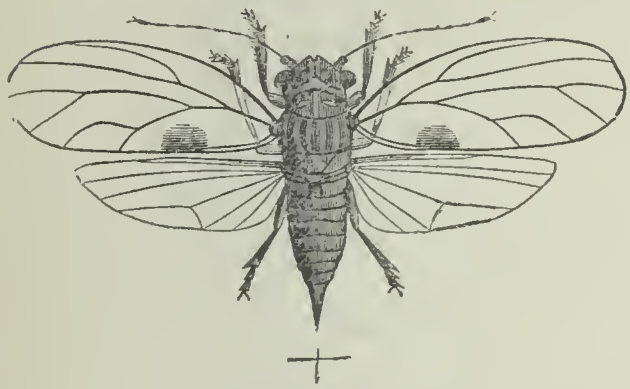
gg Antennæ inserted above the ideal line, terminal joint enlarged, sometimes elongate and then scarcely enlarged; beak with the third joint shorter than the fourth; ocelli present........ *Coreidae.*

ff Scutellum large, extending to or beyond the middle of the abdomen, sometimes nearly covering it; usually triangular or sub-orbicular; antennæ sometimes five-jointed........ *Scutelleridae.*

PSYLLIDÆ (JUMPING PLANT-LICE.)

As but few species of this family belonging to our American fauna have as yet been described, although doubtless many are to be found here, I will give the family and generic characters with a little more particularity than I should otherwise do. They are similar in appearance to the ordinary plant-lice, but the head is broader and resembles somewhat closely the head of a little leaf-hopper; it is short and generally triangular in front, and usually deeply cleft in the middle of the front; the eyes are lateral and prominent; and, in addition to these true eyes, they are usually furnished with three ocelli, or little simple eyes, placed on the top of the head in a triangular form, one close to the inside of each eye, and one on the middle of the front where the cleft or notch commences. The antennæ, which are rather long, slender and thread-like, present the most prominent characteristic for distinguishing the family, in the two little bristles with which each is usually furnished at the tip; they are usually ten-jointed, though in some species they have but nine or even eight joints, and if I am not mistaken, in one American species there are eleven; the basal joint is usually thick, and in one genus the second joint is greatly dilated. The beak is short and three-jointed, arising almost between the fore-legs. The hind margin of the sternum or breast usually terminates on each side with a little spine. The wings, which occur in both sexes, are four in number, and when at rest are placed over the abdomen in the form of a very steep roof; the front pair have a strong mid-rib or mid-vein, running through the middle and dividing near the center into three principal branches, each of which is usually further divided into two branches; the veins of the hind wings are quite slender. (See Fig. 2.) The abdomen of the females is terminated by a conical ovipositor, and in the males is usually furnished with several short, erect appendages; but in neither do we find the corniculi or honey-tubes, so common in the true aphides. The tarsi, as before stated, are two-jointed; and all the species possess the power of leaping, like the leaf-hoppers, hence the generic name, *Psylla*, which was the Greek name for a jumping insect, was given to them by Geoffroy. Their general habits are very similar to the leaf-hoppers, with which, in this respect, they appear to be closely allied.

Fig. 2.



PSYLLA PYRI.

They subsist, in all their stages, upon plants; and the species are doubtless very numerous, although but few, as before stated, have been described in this country. The larvæ have the body quite flat, the head broad, the abdomen rounded, and the antennæ, at first, apparently one-jointed; the pupæ show the rudimentary wings, in the form of four, comparatively large, broad scales, attached to the sides of the thorax. Many of the species are covered, during the larva state, with a delicate cottony substance, usually arranged in flakes; though some, as our most common species, are naked. A few species, as for example one which inhabits the hackberry, form galls, in which they reside.

The species, so far as I am aware, without any exceptions, deposit eggs, from which the young are hatched, and do not bring forth living young as do most of the true aphides.

The characters, therefore, by which we may distinguish them from the aphides, are as follows:

The two little bristles at the tip of the antennæ, their habit of leaping, the form of the head, and the veining of the wings.

The family has been divided into quite a number of genera, some of which depend on very slender characters, but at present we shall have occasion to refer only to two or three of these.

Genus DIRAPHIA.

There are no common names by which to distinguish this or other generic groups from each other. I am unable to give at present, the full characters of this genus, which, I believe, was established by M. Waga, but as it was originally included in *Livia*, with which it is closely allied, I may from this fact and from the characters of some of the species, give sufficient for the reader to locate some of the species with reasonable certainty.

In *Livia* the head is square, flat above, deeply cleft in front, extending anteriorly in two conical tubercles; no ocelli, or little eyes; antennæ not much longer than the head and thorax; ten-jointed, the first joint short and thick, the second joint much dilated or enlarged, and three or four times as long as the first; the seven following of equal size, small, the last tipped at the end with two minute bristles, usually of unequal length; wings as heretofore described, except that the front pair are sometimes slightly leathery and but semi-transparent.

Serville and Amyot say that *Diraphia* differs from this only in having the head much larger, and the second joint of the antennæ not being comparatively as long as in that genus. They also appear to doubt the propriety of the formation of the genus. In fact, Dr. Fitch, when he first described the following species, placed them in *Livia*; therefore for all practical purposes, the two may be considered as synonyms:

1. *Diraphia vernalis*, Fitch. The Vernal Diraphia or Jumping Plant-louse.

Found upon the leaves of the pine during the greater part of the year, puncturing them and sucking their juices. They are of an orange-yellow or bright rust-red color, about (.15) one-seventh of an inch in length, with a square-flattened head, concave on its upper side, with a slight, impressed line along the middle of the front. The antennæ short and thread like, about as long as the head; their basal joints largest, and forming one-fourth of their entire length; the forewings thick and leathery, feebly transparent, dull, pale, brownish yellow; the breast coal-black and legs pale.

2. *Diraphia femoralis*, Fitch. The Black-legged Diraphia.

This is probably only a variety of the preceding species, from which it differs only in having all of the thighs of the same deep, black color as the breast. Found on pine leaves in July.

3. *Diraphia calamorum*, Fitch. The Calamus Diraphia.

Found on the sweet-flag (*Acorus calamus*), about one-tenth of an inch long to the tip of the abdomen, and one-seventh to the tips of the closed wings. It is paler than the preceding, being, according to Dr. Fitch, of a dull gray or clay color, with the anterior lobes of the head of a reddish tint, and has no impressed line along the middle of the head. It is black beneath, with the abdomen and legs dull whitish. In other respects agrees with *D. vernalis*.

4. *Diraphia maculipennis*, Fitch. The Spotted-winged Diraphia.

This is a smaller species than the preceding, being only about one-tenth of an inch long to the tips of the wings. It is of a tawny-red color, the thorax being shaded more or less with dusky; the antennæ have a broad black band near the tips. The fore-wings somewhat shorter and broader than in either of the preceding species; hyaline, with a broad smoky band at the tips, a spot back of the shoulder, and some freckles near the margin, of the same color; the marginal and other veins all white, alternating with numerous black rings. The breast, blackish; legs, dusk or brownish.

Also found on the sweet-flag.

Although apparently of but little importance economically, these species, as well as a number of others, are described, not simply to make the list complete, but as a means of illustrating the genus, so that other species, if found, may be readily located in their proper place. So far but few species belonging to this family have ever been particularly injurious, either in this country or in Europe, but every now and then the cultivation of a new plant, increased cultivation of one hitherto but little used, or some similar cause, produces the sudden increase of a species previously scarcely noticed.

Genus PSYLLA (Jumping Plant-lice.)

In this genus the head is strongly inclined and flat above, and usually, if not always, obtusely triangular in front; the front cleft is not generally as distinct and marked as in *Livia*. The eyes are usually globular and prominent, not flattened as they commonly are in the previous genus; ocelli or little eyes distinct, three in number, placed in a triangle on the upper side of the head, one on each side, near the inner border of the eye, and the other in front. The antennæ are usually as long or longer than the body, slender and thread-like; the first two joints short and thicker than the others; the third the longest, the last short with two short bristles at the tip. Beak very short, arising apparently from the breast, a little behind the first pair of legs; in repose it usually remains nearly perpendicular, composed of three joints, the last very short. The wings thin and transparent, the front pair a little thicker than the hind pair. The hind legs adapted for leaping; the tarsi or feet two-jointed.

The eggs of the species, so far as observed, are oval and somewhat conical in form, pointed at one end and rounded at the other, and furnished, usually, at least, with a kind of beak or appendage near the larger end. They are very commonly deposited in a cottony substance, and are usually yellowish or reddish. It is stated in reference to some species, that the female punctures the bark and places her eggs in the punctures, but this does not appear to be the general rule; at least, the Psylla of Figure 1, deposits its eggs in the little crevices and under the little scales around the leaf-bud, turning the beak underneath out of view, and possibly slightly inserting it into the bark to secure the egg in its place.

The larvæ are usually somewhat long in proportion to their width, and often covered with a cottony substance, formed by a secretion which exudes from the pores of the body; but our best known and most common species forms an exception to this somewhat general rule. The pupæ are easily distinguished by the two scales on each side, which are rudimentary wings; also by their rounder and more plump form.

Their normal method of passing the winter appears to be in the egg state, but this is by no means the universal rule, as the same species is sometimes found both in the egg and larva state during the winter, resembling in this respect some true Aphidians. There are usually several broods during the summer all produced from eggs deposited by the female after fertilization by the male, agamic generation being apparently unknown in this family. But all the females which deposit eggs do not acquire wings. According to Macquart the eggs deposited in the summer hatch in eight or ten days, soon after which (in the case of the Psylla of the larch) the young larvæ disperse upon the foliage.

The species of this genus are somewhat numerous, and, as in *Aphis*, are usually named after the plant upon which they reside—entomologists taking it for granted that as a rule, a *Psylla* or an *Aphis* will be found on but one species of plant.

5. *Psylla pyri.* The Jumping Plant-louse of the Pear-tree. (Fig. 2.)

This species has the head but moderately cleft in front, and produces two if not more broods during the summer. The young are not covered with a cottony substance, but are naked.

The following history of its operations, derived chiefly from Harris, Kollar and others, will, with the description given below, enable the orchardist to detect it whenever it invades the premises:

It infests pear trees, to which its operations appear to be almos exclusively confined, and is found on these, in some of its forms, from May to October in the northern sections, and from April to Novembe in the southern sections, and is probably two or three-brooded, varying somewhat according to latitude. According to Kollar, the Europea Pear-tree *Psylla* (which is the same as our species, it being imported comes forth from its winter retreat, provided with wings, as soon a the buds of the fruit trees begin to expand. After pairing, the female lays her eggs in great numbers, near each other, on the young leaves and blossoms, or on the newly formed shoots.

The eggs are oblong, yellowish, and look somewhat like grains o pollen. The young insects, soon after they are hatched, resembl young, wingless plant-lice (true Aphides,) and are of a dark yellov color. They change their skins and color repeatedly, and acquire wing scales or rudimentary wings; then fix themselves to the bark in rows and remain sucking the sap until about to undergo their last change when they disperse among the leaves, cast off their skins and appea in their winged form.

While Kollar is doubtless generally correct in reference to the histor of this species, his statement in reference to the eggs and the metho of hibernating must be received with some caution. Leon Defour, i his admirable "Researches upon the Anatomy and Physiology o Hemipterous Insects," speaking of the *Psylla* of the fig (*Psylla ficus*) a closely allied species, remarks that he dissected, at the end o October, a female far advanced in gestation, thereby ascertaining th character of the eggs, which are peculiar. That in November h hunted the leaves and summits of the plants on which these insect had been abundant, but failed to find any eggs corresponding to those of the female he had dissected. Renewing his search with greater care in the early part of December, when all the leaves were off, he succeeded in finding the object of his search. These were found in the little crevices and under the little scales around the buds, but not on the buds themselves. They were naked, without any cottony covering, disposed without order, sometimes isolated and sometimes aggregated. They were ovoid, furnished on the side near the larger end with a short curved beak. When seen in position the beak is not apparent, as it is on the under side and forms the attachment to the bark; they are also sometimes furnished with a minute filament, and are of a reddish yellow color.

It is very probable that careful examination of the eggs of the pear-tree Psylla will show that they are similar to those of the fig-tree Psylla; also, that they pass the winter in the egg state, and that their eggs are placed on the branches or bud stalks, It is more than probable that this method is somewhat varied for the summer brood.

As before intimated, this is an imported species, brought from Europe on imported pear-trees, and was first observed in this country in 1833.

I have no positive knowledge that it has yet reached Illinois, still I think it more than probable that it has. So far as observed in this country the following appears to be their mode of operating: they insert their short beaks in the bark of the twigs and small branches, and pump up the sap to such a degree that the fluid oozes from their bodies, and mingling on the bark with their castings, forms blackish, rusty patches. The presence of these pests on pear-trees is generally indicated by swarms of flies or ants, which are attracted thither by the sweetish fluid which issues from the Psylla. As a rule, young trees appear to be more liable to their attacks than old ones,

Remedies.—Wash the twigs with a brush which has been dipped in strong soap-suds, or some noxious mixture of this kind. Harris recommends a mixture of strong soap-suds and flour of sulphur. This must be done before the buds expand.

A better remedy will be perhaps, to wait until after the eggs are hatched, then apply ordinary soap-suds, whale-oil soap-suds or lime water, as strong as the plant will bear without injury. Kerosene cautiously applied will be effectual.

Spec. char.—The young are usually of a dull orange-yellow color; short, and obtuse behind; and as they advance to the pupa state, acquire little wing-scales.

The perfect or winged individuals, are about one-tenth of an inch long from the front to the tip of the closed wings; the eyes are large and prominent; the head and thorax are of a brownish-orange color, the abdomen greenish; the wings are transparent, ample and marked with very fine dark veins.

6. *Psylla rubi*, W. and R. The Blackberry Flea-louse.

I know nothing further of this than the short notice given of it in the *American Entomologist.* The writer, a resident of New Jersey, describes its operations as follows: "The suckers upon which this insect occurs in the spring commence to twirl around, and, when not interfered with make a complete revolution before they resume their usual course. The leaves curl up, and become matted around the curl so as to make a safe harbor for the lice-like larvæ, which during the summer, appear on the under surface of the leaves. I presume we can get clear of this insect, after the larvæ are produced, by cutting off the curls and burning them."

Although neither of these species has been positively detected in Illinois, I have some reason to believe that the former or some closely allied species, appeared on fruit-trees in the vicinity of Chicago last year. I tried, but failed, to procure specimens, so was unable to decide with certainty.

The following species of this genus were described by Dr. Fitch, in 1851, in a catalogue of the insects in the New York Cabinet of Natural History. I give his descriptions as I find them as I am unacquainted with them. He appears to have been unacquainted with the habits of the first two:

7. *Psylla tripunctata.* Fitch. The three-dotted Psylla.

Wax yellow, with black back; legs and antennæ, pale yellow, the latter black at the tips; the front wings transparent (hyaline); nerves brown, widely margined with smoky yellow beyond the forks, a blackish dot on the middle of the terminal margin of each of the inner apical cells. Length .16 of an inch. Female.

8. *Psylla quadrilineata.* Fitch. The four-lined Psylla.

Bright fulvous or yellowish; the front wings, hyaline; the nerves, blackish; four whitish longitudinal lines on the middle of the hind thorax (metathorax); abdomen black with a yellow band at its base.

Length, .12 of an inch. Female.

9. *Psylla carpini.* Fitch. The Hornbeam Psylla.

Light green or greenish yellow; fore wings, hyaline; nerves, light green. Length, .16 of an inch. Male and female. Common on the Hornbeam in July.

10. *Psylla annulata.* Fitch. The Annulated Psylla.

Straw yellow; legs, white; fore wings, hyaline, with the nerves straw yellow; antennæ black, except the basal portion, which is straw yellow, annulated with black. Length, .15 of an inch. Male and female. Occurs on the sugar-maple.

11. *Psylla urticaecolens.* The same author mentions another species with the above name occuring on the nettle. I have not seen the description of this species.

12. *Psylla quadrisignata.* This species is also mentioned by Walker but I have not seen the description.

Mr. Walsh alludes to a species found by himself and Baron Osten-sacken, forming true galls on the hackberry; and Dr. Harris alludes incidentally to species found on birch and alder, which have the young covered with a cottony substance, as is usually the case in this genus.

APHIDIDÆ. True Plant-lice.

SYNONYMS.—*Aphides*, Linn. *Aphidina*, Burm. *Aphidinæ*, Rondani. *Aphidæ*, Leach. *Aphididæ*, Passerini.

This family embraces all of the true plant-lice, of which cabbage lice, wheat-lice, the woolly aphis of the apple-tree and the phylloxera of the grape-vine, are representatives. It includes some of the most destructive species belonging to the entire order, and presents one of the strangest physiological facts appertaining to the entire insect class.

But I must here warn the reader against the very common error of supposing that the little black flea-like insects often found on young cabbages, turnips and other succulent vegetables are plant-lice, as these belong to an entirely different order. The only insects known as plant-lice, which are in the habit of leaping, are those included in the family *Psyllidæ* which have already been described; the true plant-ice do not leap, but are usually found stationary in groups or colonies, are soft-bodied, and are furnished as heretofore stated, with a slender beak with which they suck the juices of the plants on which they are found.

The family contains a large number of species which has caused entomologists to search carefully for permanent characters by which to divide it into groups or divisions.

Their small size and the difficulty of preserving specimens for examination has rendered this aggregation into groups and genera a slow and difficult process; and even at the present day it may be truly said that no entirely satisfactory arrangement has been reached; that given here is based upon what is found in the most recent works on the Aphides and my own observations, Buckton, Passerini and Koch being my principal guides.

Before alluding to the classification or arrangement and characters of the sub-divisions of the family, or describing species, it is proper I should explain the various terms used, with which the unscientific reader is presumed to be unacquainted and give briefly the characteristics of the family.

NOMENCLATURE.

As an explanation of the more general terms used in Entomological writings has been given in previous reports of the State Entomologist of Illinois, it is unnecessary for me to repeat it here. I shall therefore confine my explanations to the terms relating chiefly to plant-lice, or which are used in a different sense when applied to them, from what they are when applied to other insects.

Larva.—As these insects do not undergo that remarkable transformation seen in the life of the beetle in its change from a grub (larva) to the apparently lifeless chrysalis (pupa) and then to the perfect insect, and in the butterfly in its change from the caterpillar to the chrysalis (pupa) and then to the perfect insect with its gaudy colors, the term *larva* does not have the marked signification it does when applied to other orders of insects. It may be defined in a general sense, as the young, wingless plant-louse. It is similar in form and general appearance to the full-grown insect, and it is somewhat difficult to distinguish it from the full grown wingless individuals.

Pupa.—This term is usually applied only to that stage of the winged individuals, during which the embryo wings appear like little scales at the sides. As these insects never go into the quiescent or apparently lifeless state of the true chrysalids of the beetles and butterflies, the wingless specimens have no marked or readily distinguished pupa state, and hence this term is seldom applied to them.

Imago.—The perfect insect, or the individual which has passed through all its moultings and has acquired its full growth, whether winged or wingless. In the plant-lice the large majority never acquire wings, but remain feeding during their short period of existence on or near the particular spot where they are born.

On account of their singular method of reproduction, which will hereafter be explained, it has been necessary to introduce additional terms for the various forms of the different sexes. The male, so far as yet known, assumes but one form in species, (except possibly in some species subject to dimorphism or polymorphism, terms which will be explained hereafter) ; the females, however, present such marked differences in their habits that it is necessary to distinguish them. Some are winged while others are apterous ; some produce only living young while others produce only eggs.

The *male* as a general thing, in fact almost universally, is winged; exceptions are to be found undoubtedly in those species which never acquire wings ; one or two European Entomologists think they have in a few instances observed wingless males in species where some individuals acquire these organs.

Winged viviparous females : A winged female which produces only living young.

Apterous or wingless viviparous female: A wingless female which produces only living young.

Apterous or wingless oviparous female : A wingless female which produces only eggs.

The term winged oviparous female is not used, as up to this time few instances have been found where the oviparous individuals were winged, and these only in the lower types, where as will be shown hereafter, the method of reproduction is only oviparous.

Agamic.—Is a term which is applied to those females or asexual individuals which produce young without the intervention of the male. *Agamic female* is not precisely equivalent to *oviparous female;* although the latter is *agamic*, it applies to reproduction without the intervention of the male whether it be viviparous or oviparous.

External Anatomy.

The external integument or skin which forms the skeleton and acts as the basis for the attachment of muscles, instead of being rigid or leathery as in most other insects, is soft and yielding, rendering the muscular power feeble, and allowing but comparatively little activity. This condition of the external skeleton renders these insects very susceptible to injury. The body is soft and yielding and usually ovate, or oval in form; and when contracted by the partial losses of their juices, the skin is thrown into more or less marked folds or wrinkles. It is divided into rings or segments, but the number does not appear to be constant; as in some species certain rings are hidden or wanting.

The division into head, thorax and abdomen is manifest, and is very distinctly marked between the two former (head and thorax); but in many wingless species, especially some of the subterranean ones, the thorax and abdomen are only distinguished by noting the number of the segments or those that bear the legs.

The various appendages to these divisions will be noticed as each division is considered.

The Head.

The head in plant-lice is sufficiently distinct to be recognized by the most unscientific observer. It is usually nearly quite as broad as the front of the thorax. Seen from above it is transverse, the width exceeding the length; the front flat, slightly concave, or with the middle portion slightly advanced in a triangular form. Seen from the front it is triangular, with the base-line above extending from one eye to the other, and the apex below terminating in the beak. Seen from the side it also presents usually a triangular outline approaching a right angle triangle, the top and back forming the base and perpendicular, and the front the hypothenuse, which is sloped strongly under towards the breast. In some genera, especially *Siphonophora*, seen from the side, it reminds one very strongly of the head of a goat. In fact so marked is this that it often assists in determining the generic relation of a specimen which is injured or imperfect. To it appertains the following parts and appendages:

Beak.—Which is sometimes designated by the terms *Rostrum*, *Proboscis*, *&c.*, is the prolonged and jointed mouth which arises from the back part of the underside of the head, and when at rest is usually turned under and pressed up against the breast, but is often seen directed obliquely downwards and backwards apparently from a point between the fore-legs.

It is divided into three joints, of which the basal or first is usually much the longest. It is in fact an extension or prolongation of the under lip; the first joint being deeply channelled above for the purpose of receiving and protecting the slender, hair-like setae or piercers, which are the weapons these insects use to pierce the leaf or bark on which they feed; the second or middle joint is perforated instead of being channelled, thus securing the slender piercers in their position; the third joint, is channelled above, and pointed at the tip. With a magnifier, the slender setae (of which there are three) may often be seen thrust out considerably beyond the point of the beak by the living insect, darting out and in like the tongue of a serpent. These organs, which represent the jaws and mandibles of other insects, are the real instruments with which the plant-lice first pierce the plants, which is not done by the beak as is generally supposed. Its length, as compared with the body, is used as a character in describing genera and species, in some not extending, when pressed up against the breast, to the base of the middle legs, while in others, as various species of *Lachnus*, and *Schizoneura*, it extends beyond the base of the hind legs sometimes nearly or quite to the tip of the abdomen; in *quercus*, *Stomaphis* (an exotic species) it is nearly twice the length of the insect. The *base* of the beak is the part by which it is joined to the head, the tip or apex the other extremity.

Antennæ.—The jointed bristle-shaped appendages which arise from the upper part of the head, and are sometimes improperly termed horns. Although subject to less variation than what is found in some other orders, yet the differences are sufficient to furnish important generic characters. They vary in length from twice the length of the entire body or even more, to but little more than that of the head; and in the number of joints from seven to three, never exceeding the former and never less than the latter in the adult state. The typical form is setaceous or bristle-like, and the widest variation is but a modification of this type. Throughout the family, as a rule which has but few exceptions, the two basal joints are shorter and thicker than those which follow; the third is usually longest, though in *Siphonophora* and one or two other genera, the seventh sometimes equals and even exceeds it; in these genera the latter resembles a slender bristle, usually making a sudden offset at its junction with the sixth, the articulation being always indistinct between these two joints. In *Lachnus* and some allied genera which are often classed as six-jointed, the sixth is furnished with a spur at the tip which is evidently a rudiment of the seventh, but, as in the others, the articulation between the two is not apparent. In the five-jointed antennæ of the subterranean species, the fifth (see fix) is but a minute almost imperceptible tubercle.

In the seven-jointed antennæ, the last is often imbricated, sometimes it and other joints are partially surrounded by minute rings; the third joint of the winged specimens is also often marked with little circular pustules or hollow tubercles which are supposed by some entomologists to be in some way connected with the sense of hearing.

In *Siphonophora* and one or two other genera, these organs are situated on short frontal tubercles; while in all the other genera they articulate directly with the head without the intervention of a tubercle.

The larvæ, and often the pupæ, especially of the seven-jointed species, lack one or two antennal joints, a fact that should always be taken into consideration in describing or determining species. The addition takes place not by the growth of new joints at the tip, but by divisions usually of the third, or at least by a division of some one of the joints between the second and sixth, but from my observations I think it is chiefly by divisions of the third.

Front or Vertex.—That part of the head between the antennæ. It is sometimes grooved, sometimes flat and in other species convex.

Eyes.—These are usually very distinct and prominent during the entire life of the insect, in fact they may often be seen in the embryo before it has left the parent; but in some of the subterranean species these important organs are wanting. In many winged specimens a small tubercle may be observed on the back portion of each eye.

Ocelli.—These are minute simple eyes placed on the front of the head; there are usually three of them, but are very difficult to find even with a microscope.

Thorax.

This forms the middle portion of the body, and supports the legs and wings when present, and is composed of three pieces, the front portion or ring is the *Prothorax*, and supports the front pair of legs; the *Mesothorax* or middle portion bears the middle pair of legs and also the front or upper wings when present; the *Metathorax* is the hinder portion to which the abdomen is attached, and bears the hind pair of legs and the hind or under wings when present.

The *Prothorax* or first segmemt behind the head, is connected with the head by "a dense membrane which shows itself often as a light colored band" (Buckton). It is usually smaller than the following segment, and narrower than the head; but an exception to this rule occurs in the case of the winged *Chermes*, which has this division developed until it is nearly or quite as large as the mesothorax. The upper side or dorsal surface is the *Pronotum*, the under surface the *Prosternum*, though these terms are seldom brought into use in describing species of this family. As before stated this division supports the first or anterior pair of legs, which are attached to the underside; the points of attachment being sometimes designated as the *Fulcra*.

The *Mesothorax* or second segment behind the head, is usually much the largest and most conspicuous portion of the thorax, bearing the second or middle pair of legs, and the upper or fore-wings, when present; in some wingless and especially subterranean species there is scarcely any difference in form between the segments which form the thorax and those which form the abdomen, as may be seen by reference to fig. 32—(*Tychea panici*, Thos?). The upper surface—*Mesonotum*, which is sometimes spoken of as the *disk* of the thorax, in the winged specimens usually presents three conspicuous lobes or rounded tubercles; these are sometims black, while the rest of the thorax is green as may be seen in some specimens of *Aphis mali*. The underside or *Mesosternum* is deeply excavated to receive the folded beak.

Wings.—These organs are of the highest importance in determining species, as they enable us more easily than any other character to determine the genus or group to which a specimen belongs.

The front or upper pair is usually much larger than the hind pair, and the former are generally connected with the latter by a minute compound hooklet situated on the front or costal margin of the latter. They are usually very delicate and membranous, and mostly transparent, though occasionally dimmed by smoky or fuscous patches.

As a very general rule some individuals of each species at some time during the season acquire wings, but there are a few subterranean species which do not, so far as known, present winged individuals. In most species, the wings, during repose, are placed nearly perpendicular above the abdomen, with back to back, in the form of a very steep roof, when they are said to be *erect.*

The method of folding these organs is unusual. Instead of simply raising them upward so as to bring them back to back, they are drawn backward from the expanded condition, keeping the anterior margin below, and elevating the posterior, so that when they come together the under sides stand face to face and the posterior margins upwards. In others they are placed flat upon the abdomen, slightly overlapping at the tips; this position is termed *horizontal.*

The venation or number and position of the veins or nerves affords most excellent characters, and in order to abbreviate and render more certain, descriptions, the following nomenclature of the veins and intervening spaces or cells has been agreed upon.

The front margin is the *costa* or *costal vein*, Fig. A. *c;* the strong median vein running from the base (part next the body) outward near the front margin, is the *sub-costal* or *sub-marginal* vein, sometimes termed the *cubitus* and *mid-rib;* the hind edge, the *posterior margin.* The oblique vein nearest the base, crossing from the sub-costal vein to the posterior margin, is the *first oblique* or *first discoidal* vein ; the next transverse vein is the *second oblique* or *discoidal vein* ; the next is the third *oblique* or *discoidal vein*, but by some it is termed the *cubital* vein; these three veins are sometimes spoken of simply as the first, second and third veins. The third of these veins sometimes forks near the middle, sending off a branch towards the apex of the wings, this is the *first fork* or *first furcal vein* and continues outward to the apex : in many species it likewise forks near the middle, sending off a branch to the posterior margin between the extension of the first fork and third vein, this is the *second fork* or *second furcal vein.*

The sub-costal vein, toward the tip of the wing, expands anteriorly, connecting with the costa, and forms a somewhat elongate and narrow, slightly thickened spot, this is the *stigma*; from the posterior side of this, near its extremity, starts a slenderer vein which makes a curve and extends outward to the apex of the wings, this is the *stigmatic* or *fourth vein.*

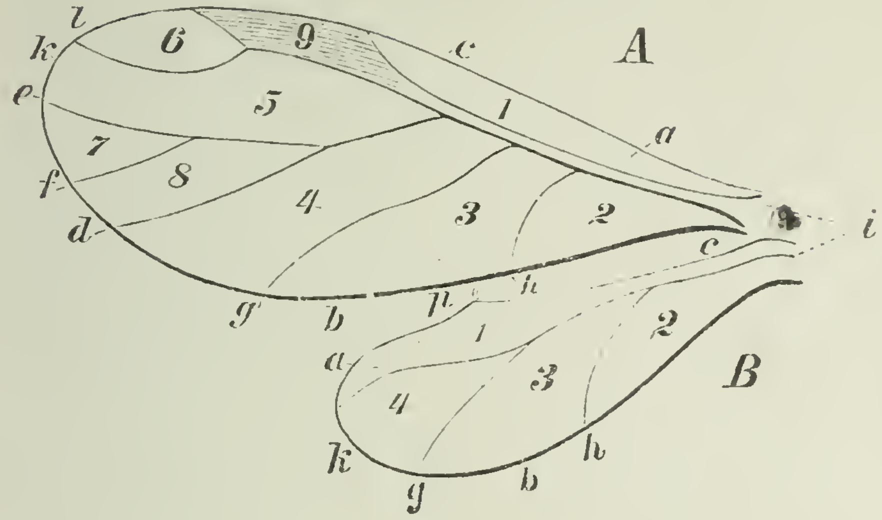
The cells, or spaces between the veins, generally take their names from the neighboring veins, thus: that between the front margin and sub-costal vein is the *costal cell*: that between the first oblique vein and the base, is the *basal* cell; between the first and second, the *first discoidal cell;* between the second and third, the *second discoidal;* between the third vein and second fork, the *first cubital;* between the first and second forks, the *second cubital;* between the first fork and stigmatic vein, the *infra marginal;* that between the fourth vein and margin, the *marginal cell.*

The hind wings have the similar veins and cells named in the same manner.

In the front wings, sometimes the third discoidal vein has but one fork, sometimes it is without any, when it is said to be *simple;* and in a few species even one of the branch or discoidal veins is wanting. The hind wings usually present two branch or discoidal veins, but sometimes there is only one, and sometimes none.

The following figure (No 3) illustrates the nomenclature here used:

Fig. 3. (After Buckton.)

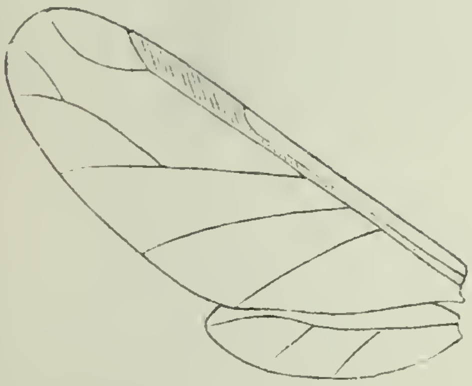


A, upper wing of Siphonophora; *B*, the lower wing of same; *a*, sub-costal vein or cubitus; *b*, posterior margin; *c*, costa or costal vein; *d*, third discoidal or cubital vein; *e*, first fork or first furcal vein; *f*. second fork or second furcal vein; *g*, second discoidal vein; *h*, first discoidal vein; *i*, the base or points of insertion; *k*, apex or apical margin; *l*, sigmatic or fourth vein; *p*, hooklet; 1, costal cell; 2, basal cell; 3, first discoidal cell; 4, second discoidal cell; 5, infra-marginal cell; 6, marginal cell; 7, second cubital cell; 8, first cubital cell; 9, stigma.

NOTE.—Nos. 5 and 6 are sometimes called apical cells.

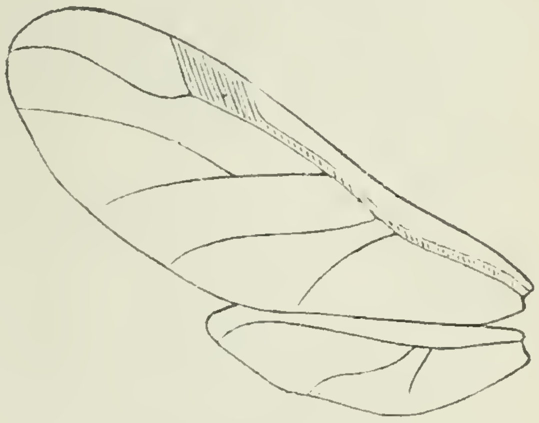
As illustrations of some of these different forms of venation I present here a few figures representing different groups:

Fig. 4.



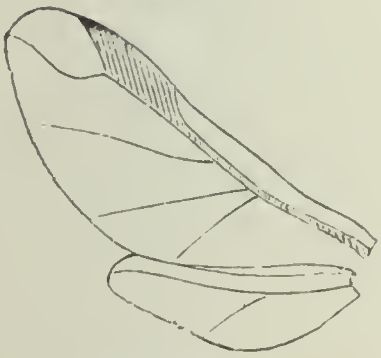
APHIS MALI.

Fig. 5.



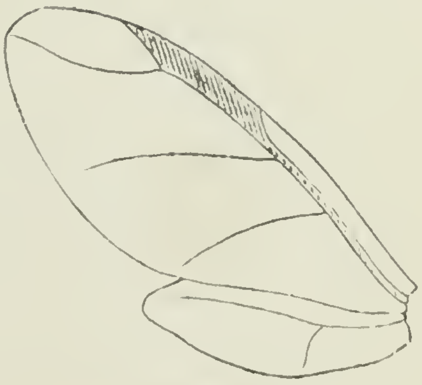
SCHIZONEURA.

Fig. 6



TETRANEURA.

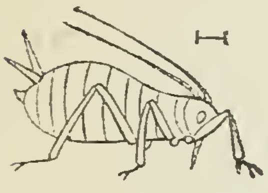
Fig. 7.



CHERMES.

Abdomen.

Fig 8.



The abdomen or hinder division of the body usually shows somewhat distinctly the segments or rings of which it is composed; it is generally much the largest of the three divisions of the body, and usually oval or ovoid in shape and convex. From the posterior portion (sixth segment) in very many species, at each side arises a little cylindrical horn, or more properly speaking, tube, as it is perforated. (See Fig. 8) These have received various names, as *honey tubes*, *cornicles*, *nectaries*, etc. I use the first. In some species they are nearly equal in length to one-third the length of the body, in others a little shorter, and so on until they are but mere tubercles, while in a number of species they are entirely wanting. These and other differences in these organs furnish generic and specific characters. They are called honey tubes because it is believed, and perhaps correctly, that honey dew is extruded from them. They are considered *long* when they exceed in length the distance from their base to the tip of the abdomen; *medium* when they about equal this distance; *short* when their length is less than this distance; and *tubercular* when their length is less than their diameter..

They are usually cylindrical or slightly enlarged at the base, but in many species are enlarged or slightly swollen towards the tip.

The *tail* or *cauda* is a small process extending back from the tip of the abdomen, usually rounded or pointed, sometimes sword-shaped. Generally, when the honey tubes are wanting, the tail is also absent. This is not an ovipositor, but simply a process from the upper arch of the last segment.

The *legs* have the usual division, *femur* (plural femora) the thigh; *tibia* (plural tibiæ) the shanks, and *tarsus* (plural tarsi) the foot. The tarsus is composed of but two joints, the outer one terminating in two slender claws.

CHARACTERISTICS OF THE FAMILY.

The species belonging to this family may be distinguished from the *Psyllidæ* by their antennae, which never contain more than seven joints (the number ranging three to seven), and being without the two bristles at the tip. They are distinguished from the *Aleurodidæ* by their naked, membranous and usually transparent wings.

They are small insects, seldom reaching one-fourth of an inch in length, and sometimes less than one-twentieth; their bodies are soft, and the external integument comparatively tender and delicate, thus rendering them very subject to the attacks of predaceous insects and parasites.

The beak is three jointed, varying in length from less than the distance between two pairs of legs, to more than the length of the body. The legs are usually long and slender, the hind pair being sometimes elongated, as though formed for leaping, although none of the species appear to posses this power. The head is not so broad as in the *Psyllidæ*; nor is the thorax as greatly developed in proportion to the size of the abdomen. The ocelli or little eyes are sometimes present, sometimes wanting, but on this point, on account of the difficulty of finding them even when they exist, there is considerable difference in opinion, some contending they are usually absent, while one or two of the latest authorities contend they are generally present.

The honey tubes also form a characteristic of the family, though subject to numerous exceptions where they are wanting.

The character and veining of the wings as heretofore described form tolerably good distinguishing features of most species; some of the different forms and modes of venation being represented in figures 4, 5, 6 and 7. The chief difficulty in using the wing characters arises from the fact that the very large majority of the individuals we see are without these organs, and do not acquire them during life; yet, as will be seen hereafter, there are few, if any, species without winged individuals, of one or both sexes, during some portion of the year, although brood after brood lives and dies with most of its members wingless. The very great similarity of the wingless individuals of the different groups, renders any specific characters derived from their color, markings, etc., often of doubtful value; and this fact has so impressed itself upon the casual and ordinary observers that they usually designate them, no matter where found or what their habits, by the common name Plant-lice, as though all belonged to one species.

Naturalists have therefore sought some more positive method of distinguishing species from each other; this has been found in their habits.

It was the belief of the immortal Linnæus that every plant supported a distinct species of Aphis, or, in other words, that a species of Aphis inhabited but one species of plant; and Curtis, the great English entomologist, tells us that, after careful and extensive examination of this subject, he is inclined to subscribe generally to this opinion, adding that, although a species of Aphis is limited to a certain plant, yet there may be more than one species of plant-louse to one plant.

Although most species have the bodies naked, there are many which are more or less covered when young or during life with a cottony or downy substance, on which account they are often called "Wooly plant-lice." This substance is secreted by certain glandular organs situated in the thorax and abdomen. It is not, as is supposed by many, a waxy secretion, but when held over the lamp scorches brown, giving off an odor like burnt feathers. It is composed of fibers or reduced to particles giving the insect the appearance of being covered with fine meal.

Life History and Habits.

As a general rule plant-lice prefer warm and somewhat moist situations, which are sheltered from the direct rays of the sun and strong drafts of air. Some species feed exposed on the upper surface of leaves, but many more select the underside where they are less exposed to the sun and their numerous enemies. By constantly withdrawing the sap they cause the leaves to curl and blister, and gradually losing their vitality, to die. Others select the young twigs of trees and tender shoots or stems of plants; while others reside upon the trunks and branches, where by constantly drawing the sap from the bark they not only lessen its vitality, but cause it to split, wrinkle or become roughened, thereby rendering the plant liable to disease and injury by climatic influences. Any one who has watched the operations of the wooly aphis, of the apple tree, is aware how rapidly a little colony causes a minute crevice in the bark to expand.

Some aphides limit their attacks to timber trees exclusively; others feed on soft succulent vegetables and low herbs; while others infest the roots of grasses and other plants, or hide under stones and the rotten mortar of old walls.

Although some plants, especially trees and shrubs, appear to be attacked only by their peculiar aphis, other trees are infested by several species, each appearing to select only a certain part as its point of attack, a few changing during the season from one portion to another; for example, the Grape Phylloxera passes from the leaves to the roots; the Wooly aphis from the bark to the roots; the Corn louse from the tassel to the ear stalk and thence to the root. Some, by a peculiar property not fully understood, are enabled to form galls upon the leaves, in which they pass their entire existence through numerous generations, and until the time arrives for them to seek their winter quarters, or homes for new colonies. As these insects are not furnished with jaws by means of which they can cut their way out of their prisons, by a wise provision of nature these galls always form so that a minute passage remains open as a means of exit. This fact enables the entomologist to decide at once whether a gall is the work of an Aphis or some other insect.

Some families of plants appear to be exempt from the attacks of these insects. For example none have so far been observed to feed upon the *Fumariaceae*, the *Gentianae*, or the *Iridae*. The *Labiatae* are almost wholly exempt, as are the Ferns and other Cryptogamic plants. Acridity and poisonous qualities do not appear to prevent their attacks, as some of the most virulent plants are infested.

How those species which inhabit annuals, pass the remainder of the year after these plants die, is not well understood, and is one of the points which needs further investigation, as it may possibly furnish one method of counteracting such as are injurious to useful annuals.

These insects, as others, undergo, in their process of growth, several moultings, that is, cast off their outer or external integument; the number of moults through which they pass is supposed to be four, but in regard to this there is some difference of opinion.

One of the strangest facts connected with the history of the plant-lice is their method of reproduction. But in order to understand this it is necessary to give a brief account of their life history through one season as is generally observed.

These insects, as likewise all other species belonging to the order Homoptera, undergo only a partial metamorphosis or transformation, that is to say, they never are worms or grubs, and never undergo those remarkable changes which transform the grub into a beetle, and the caterpillar into a butterfly. The larvæ and pupæ are similar to the perfect insect in form and habits; and although they frequently cast their skins, and the winged specimens gradually acquire these organs, there is no true dormant pupæ or chrysalis state, as we find in many other insects. Their whole lives are therefore devoted to imbibing food and in producing new broods.

In the autumn, as a general and almost universal rule, the last brood, onsists of winged specimens, both males and females. These pair, oon after which the male dies; the female deposits her eggs, after hich she also dies. Early in the spring, as soon as the sap begins o flow, these eggs hatch, and the young lice at once insert their tiny eaks into the bark or leaf on which they are situated, and begin to ump up the sap. They wander but little, their entire time being de- oted to feeding; hence they grow rapidly, and soon come to maturity.

This spring brood consists, generally without an exception, of females ithout wings. These females, by some strange provision of nature, re capable of reproducing their kind without the intervention of the ales, and, instead of depositing eggs, as the last fall brood, are usu- lly viviparous, bringing forth living larvæ. These are likewise all fe- ales, similar to those from which they sprang, and they, in turn, roduce a similar brood in the same anomalous manner. This process s repeated again and again during the summer and until in the fall, hrough some six or seven or even more generations. The last fall rood presents a remarkable change, for it usually consists almost ntirely of males and females which acquire wings. These winged emales, as previously stated, after pairing, deposit eggs which remain ver the winter.

This is the history as generally given and understood, but more areful, recent observations show that in several respects this account s incorrect. In many species winged individuals are often developed uring the middle and latter portion of the summer; some species so ar as known are never winged, yet present oviparous individuals; ome species are only oviparous. But the most serious error in this ccount as given is that in the species using this double method of eproduction the oviparous female is winged.

Among the *Aphidinae,* on the contrary, the oviparous female is pterous, but in some of the other groups it occurs in both forms, inged and wingless. In the former group the winged female is iviparous.

It was formerly supposed that this fall brood consisted entirely of ormal males and females, but careful investigation shows this to be mistake, as there are usually a number of the agamic females among hem, showing a tendency to continue the anomalous method of repro- uction, which is apparently checked by the approach of the cold eason. It has been found possible, by placing the agamic females of he summer brood in a situation of uniform and sufficiently warm emperature, to cause the viviparous generation to go on indefinitely. have even observed it going on in the middle of winter, in speci- ens of the wheat plant-louse (*Siphonophora avenae*), taken from he wheat while snow was on the ground. Instances are on record of his method of generation continuing for four years without interrup- ion.

It is proper to remark that there are some species in which the gamic females do not produce living young, but eggs—the reproduc- ion, in other respects, being similar to that described. It is also a ingular fact that there is an intermediate group, in which the young rvæ are brought forth in a very thin and delicate egg-like sack.

How is this mode of reproduction to be explained? is a question that has troubled naturalists from the days of Bonnet, who first discovered it, down to the present time. Leuwenhock and Cestoni were of the opinion that the supposed agamic females were in fact hermaphrodites. Morren, a professor of the University of Liege, after a careful anatomical examination, apparently set this theory at rest. It was his opinion—a view adopted by the celebrated Owen—that all these changes are brought about by some force concentrated in the sperm cells, or, as the latter has in substance expressed it, the spermatic force is transmitted to a mass of germ cells, and these germ cells are the direct excitants of all the changes in the successive generations of cells, until the impregnation of the next ovum. On this theory, the germ stock—for "force," as here used, can mean nothing else—would soon be exhausted, and the reproduction limited. It also requires the transmission of a part of the original germ stock through, sometimes, as many as twenty generations, and with a possible division, according to Owen himself, among more than a million times a hundred million descendants.

Another serious objection to this theory is the evidence furnished by Kyber's experiment, in which he kept up viviparious generation for four years, at the end of which the agamic females appeared to have the same power of reproduction as the first brood. I do not fully and clearly understand Huxley's theory, but the chief idea appears to be that of germination or budding, somewhat similar to that observed in some of the Polype. But his explanation of the production of the ovum in the fall is scarcely satisfactory. Dr. Burnett, according to Packard, also considers this mode of generation a process of budding similar to that seen in vegetables, and that the whole series, from the spring egg until the end of the last fall brood, is but a single generation resulting from the union which produced the egg in the fall, just as the leaves of the tree, which are renewed each year, are said to be contained in the germ of the acorn, or to result from the union of the staminate and pestillate elements that produced the acorn. The theory is the same as Huxley's in substance; but the illustration is wholly inapplicable, as the leaves are but the organs of the individual, as are the legs and antennæ of each individual Aphis.

Parthenogenesis and Agamogenesis are terms which, upon their face, are indicative of our ignorance of their meaning, and are used to express a fact without conveying an idea, if we can suppose such a thing possible. Balbiani has revived the old theory of Leuwenhock and Cestoni, that of internal impregnation or hermaphrodism. He maintains that the embryo viviparous Aphidians are hermaphrodites. He also finds a similar condition in other species considered parthenogenetic, thus striking a heavy blow at this incomprehensible theory

There are numerous facts in the life-history of some of the lower animals, as strange as it would be for the male principle to be retained under certain circumstances in the female Aphis, and separated under others. This is the simplest explanation that can be found, and it will explain how it is possible to protract indefinitely the agamic reproduction.

But it is not necessary for me to discuss this question further here for although very interesting to the physiologist and naturalist, it has but little practical value to the farmer or horticulturalist, the fact of the rapid multiplication of these insects being the chief point in connection with their reproduction with which he is concerned.

As before intimated one part of the life history of these insects, to-wit: the method by which they pass the winter—does not appear to be well understood. That a number of the *Aphidinæ*, especially those which reside on trees, deposit eggs in the fall, and in this form hibernate. is beyond doubt true. But this method is impossible in the case of those which live upon annuals that perish with the close of the season. It follows therefore that their eggs, if this is their method of hibernating, must be deposited somewhere else than on the plants they inhabit. It has been supposed by some that these are placed on the earth. But this is contrary to the usual habits of insects, as the eggs are, as a very general and almost universal rule, deposited where the young can find food as soon as they appear.

If deposited in the earth, this would, in the large majority of cases, place them where they would not be likely to find the kind of food necessary for their sustenance. It follows therefore, I think, as an absolute necessity, that some other method must be adopted. What is this? Although as yet not positively known I think a fact now ascertained may at least give us a clue to this mystery.

It is now known that a number of species in the different groups are subject to dimorphism, that is to a change in form and mode of life to a certain extent. For example the Wooly Aphis of the apple tree, (*Schizoneura lanigera*) is found upon the trunks of these trees and also on the roots; the same is also true of the Corn plant louse (*Aphis maidis*); the Grape Phylloxera (*Phylloxera vitifoliae* or *P. vastatrix* Planch), resides a part of the time in galls on the leaves and part of the time on the roots of the vine. Although the differences between the root and aerial forms are not equally marked and distinct in all these species, yet the differences in situation and modes of life warrant us in concluding that they undergo certain physiological changes sufficient to adapt them to the changed circumstances. Recent investigations have convinced me that these changes from aerial to root-inhabiting forms is not so rare as hereto supposed; and in fact I am led to believe that it will ultimately be ascertained that many which are now classed as apterous root inhabiting species are but the dimorphic forms of aerial species.

The term "Dimorphism" is used to express the fact that a species is subject to certain influences or changes which cause it to appear in a form different from that which is considered its normal appearance; or in other words that the species presents two forms. Some species, as the Graple Phylloxera are "polymorphic," or present three or more forms. The term "form" here is used to express any differences which might be used as specific in other cases, or as varietal: it is sometimes even used to indicate a wide difference in habits, but then it is on the assumptiom that such differences in habits will be accompanied by anatomical or morphological differences. To explain more clearly to those who have paid little or no attention to entomology, and to render the explanation applicable to the particular point before us, I call attention to the following fact. In some cases a species which lives during the summer upon the leaves, stem or trunk of a plant, when winter approaches, moves down to the root, where the individuals of the new generation, assume a somewhat different appearance and different habits from their aerial predecessors, the difference being sometimes so great as to cause them to be placed in entirely different groups.

And it is even possible that some which are found during the summer on annuals pass in autumn to the roots of perennial plants, though this has not yet been positively ascertained.

If we examine the roots of grasses and various other plants in the latter part of autumn or early in the winter, we will find now and then a number of pale creamy-white plant-lice clinging to them. These are very similar in appearance, short thick and convex; with very short antennae, consisting of five or six joints; the eyes minute or apparently wanting; and as a matter of course without wings. Sometimes others a little more active, of an ashy-purple color are found with them. These differ from the others not only in color but are somewhat larger, have longer antennae consisting of six or seven joints; eyes distinct; wingless. These subterranean species, on account of various minute differences observed between them, have not only been described as different specifically, but have been grouped into several different genera, the number and relative length of the joints of the antennæ, being one of the chief characters selected for this purpose.

While there are undoubtedly some species which are permanently subterranean, I am pretty well satisfied from my observation and study of these insects that a large portion of these root feeding species are but dimorphic forms of aerial species found upon plants in the growing season of the year. While in this condition, development appears to be retarded, the larva appear to remain in this state probably as long as the rigor of the season is unfavorable to development; and I have even observed that they may be caught in the pupa state, with the wing-pads formed and remain for an unusually long time in this condition, many of them possibly never acquiring full wings.

From observations made on several species I am now pretty well satisfied that a large portion of these pale, cream colored subterranean species. with short five-jointed antennae, are larvae; the bluish specimens with longer and more numerous jointed antennae are in a more advanced stage. I will not attempt to give my reason for this opinion here, as I would have to enter into details interesting only to entomologists.

If I am correct in this opinion, which Buckton, the latest English authority on these insects, appears to have entertained, at least in part, it may ultimately assist us in tracing out a portion of their life history, which is yet involved in mystery.

That many species, like the apple-tree plant-louse, deposit eggs in the fall and pass the winter in this state is well known, and it is quite probable that most of the tree-inhabiting species adopt this method, though some, as the wooly-aphis of the same tree, are known to penetrate to the roots.

CLASSIFICATION.

Although since the days of Reaumer and Bonnet (1737—1779) the Aphides have, by their singular method of reproduction, attracted the attention of entomologists, yet it was but very recently that any attempt worth naming was made to classify and systematically arrange the species of the family.

Serville and Amyot in the "*Tableau Methodique*" prefixed to their '*Histoire Naturelle des Insectes Hemipteres*" (1843), arrange the *Homoptera* in two sections corresponding with the two sections defined in he introduction. The second of these sections, which they name *Sternorhynchi*, is subdivided by them as follows:

. Beak distinct in both sexes; wings when present four.
  A. Wings transparent or but slightly clouded.
  a. Saltatorial; antennae divided at the tip into two bristles. — *Fam.* Psyllidae.
  b. Antennae as long as the body; head inclined and flat below. — Gen. *Psylla.*
  bb. Antennae not much longer than the prothorax; head square, flat and grooved above. — Gen. *Livia.*
  aa. Not saltatorial; antennae not furnished with two bristles at the tip. — *Fam.* Aphididae
  b. Abdomen with honey-tubes. — Gen. *Aphis.*
  bb. Abdomen without honey-tubes. — Gen. *Myzoxylus.*
  AA. Wings opaque and mealy. — *Fam.* Aleurodidae.

I. Beak wanting in the male; female apterous; male winged, but having only two wings. — *Fam.* Coccidae.

Kaltenbach in 1843, (*Monographie der Familien der Pflanzenlause*) rranged the family into two principal sections; *first*, those having even joints in their antennæ and posessing wings; *second*, those ith less than seven joints in the antennæ and which he considered s permanently apterous. The first of these sections he subdivided nto eight genera taking the veining of the wings as his chief guide; e second he divided into four genera. Another arrangement of the ame author was based upon the supposed method of reproduction, s follows:

1. *The vivi-oviparous*—Containing the genera *Aphis* and *Lachnus.*

2. *The exclusively oviparous*—Containing the genera *Chermes*, *Vacuna* and *Phylloxera.*

3. *The exclusively viviparous*—Containing the genera *Tetraneura*, *Pemphigus*, *Schizoneura* and probably *Forda* and *Trama.*

But the facts ascertained since the publication of his work show, that the author was mistaken in reference to the method of reproduction of several of the genera named under the second and third divisions. As I have been unable to procure a copy of this author's valuable work, I am indebted to Mr. Buckton for the above notice.

Westwood, in the "Generic Synopsis" at the end of his "Modern Classification of Insects," arranges the genera of Aphidae as follows:

APHIS. Linn. type—*A. rosae* Linn. Abdomen bicorniculate; antennae long, setaceous; fore wings with three oblique discoidal nerves, the first trifid; proboscis short; collar long.

LACHNUS. Illig. CINARA Curt. type—*A. roboris.* Linn. Abdomen bitubercled; antennae moderate, often filiform; collar short; proboscis long.

ATHEROIDES. Hal. type—*A. serrulatus.* Apterous, linear. flattened; spiracles of penultimate joint simple; antennae not longer than half the body; proboscis shorter than the body.

ERIOSOMA. Leach. MYZOXYLE. Blot. type—*L. lanigera Ill.* Abdomen without tubercles or horns; antennae short, filiform; body wooly; fore wings with simple oblique discoidal nerves.

ADELGES. Vallot. type—*A. laricis.* Vall. Legs and antennae very short, female very much swollen; legs and antennae scarcely visible; setae of the mouth very long.

BRYSOCRYPTA. Hal. type—*Aph. bursaria.* Linn. Composed for the reception of those species of *Eriosoma* which inhabit closed follicles on the leaves and shoots of plants.

PHYLLOXERA. Fonscol. doubtingly introduced by Curtis into his Guide; type—*P. roboris.* Fore wings carried flat on the back, with one simple stigmal and two simple oblique discoidal nerves.

THELAXES. Westw. type—*T. quercicola* Westw. Wings carried flat on the back at rest, anterior with three oblique discoidal nerves, the anterior bifid; antennae short.

Koch in his excellent work on the Aphides (*Die Pflanzenlause* 1854) indicates his classification by a tabular statement or list of the various divisions and genera, but without characters. I herewith present this arrangement, adding, where I can, very brief notices of the characters as he has given them elsewhere in his work, and giving equivalents for his names of the primary divisions he adopts.

A. Zweigabler (Dikyphonen.) (third branch vein twice forked.)
a. Aphiden. (No characters given.)
  1. Chaitophorus. *Koch.*
  2. Hyalopterus. *Koch.*
  3. Rhopalosiphum. *Koch.*
  4. Aphis. *Linn.*
    a. "Conophoren."
    b. "Anuren."
    c. "Brachyuren."
    d. "Prokispilen."
    e. "Katoptronen."
    f. "Pleurodonten."
    g. "Orthuren."
  5. Siphonophora. *Koch.*
b. Drepanosiphiden.
  6. Drepanosiphum. *Koch.*

c. Lachniden.
  7. Lachnus. *Ill.*
  8. Dryobius. *Koch.*
d. Callipteriden.
  9. Callipterus. *Koch.*
e. Phyllaphiden.
  10. Cladobius. *Koch.*
  11. Phyllaphis. *Koch.*
  12. Asiphum. *Koch.*
B. Eingabler. (Monokyphonen.) (Third branch vein with one fork.)
a. Toxopteriden.
  13. Toxptera. *Koch.*
b. Vacuniden.
  14. Glyphina. *Koch.*
  15. Vacuna. *Heyd.*
c. Schizoneuriden.
  16. Mindarus. *Koch.*
  17. Anœcia. *Koch.*
  18. Pachypappa. *Koch.*
  19. Schizoneura. *Hart.*
C. Dreiastler. (Trichotomen). (Three branch veins, all simple.)
a. Prociphiliden.
  20. Stagona. *Koch.*
  21. Prociphilus. *Koch.*
b. Pemphigiden.
  22. Thecabius. *Koch.*
  23. Pemphigus. *Hart.*
c. Tetraneuriden.
  24. Tetraneura. *Hart.*
d. Tramiden.
  25. Rhizobius. *Burm.*
  26. Endeis. *Heyd.*
  27. Forda. *Heyd.*
  28. Trama. *Heyd.*
  29. Amycla. *Koch.*
  30. Tychea. *Koch.*
D. Zweiastler (Dichotomen). But two branch veins, the third wanting
a. Chermiden.
  31. Anisophleba. *Koch.*
  32. Chermes. *Linn.*
b. Phylloxeriden.
  33. Phylloxera. *Fonsc.*

The following synopsis of the sub-families and genera, by Dr. Giovanni Passerini, is perhaps the best that has so far been given to the public. It is translated chiefly from "*Prospetto dei Genera*," in his "*Gli Afidi.*"

APHIDIDÆ. Passerini—(Sub-families).

A. Antennæ seven-jointed.—(1) APHIDINÆ.
AA. Antennæ six-jointed, at least in the winged form.
a. Winged form obvious, or at least known.
b. Cubital vein once forked or simple.—(3) PEMPHIGINÆ.

bb. Cubital vein twice forked.—(2) LACHNINÆ.
aa. Winged form unknown.—(4) RHIZOBINÆ.
AAA. Antennæ five or only three-jointed.
a. Winged form unknown.—(5) TYCHEINÆ.
aa. Winged form obvious, or at least known.—(6) CHERMESINAE

Sub-family I. APHIDINÆ—Genera.

A. Antennæ on frontal tubercles.
a. Antennæ closely approximate at base front groved. *Siphonophora.*
aa. Antennæ remote at base, front flat or convex.
b. First joint of the antennae with a tooth on the inside. *Phorodon.*
bb. First joint of the antennæ not toothed.
c. Nectaries or honey tubes distinctly clavate. *Rhopalosiphum.*
cc. Nectaries cylindrical, sometimes hardly attenuated at the base, more often incrassated.
d. Cubital vein twice forked.
e. Tail much shorter than the nectaries. *Myzus.*
ee. Tail longer than the nectaries, rarely equal to them in length. *Hyalopterus.*
dd. Cubital vein once forked. *Toxoptera*
AA. Antennæ not on frontal tubercles.
a. The seventh joint of the antennæ as long or longer than the sixth.
b. Antennæ smooth.
c. Nectaries longer than thick, or if shorter, or none, then the wingless female has a smooth back.
d. Nectaries cylindrical (very rarely none.) *Aphis.*
dd. Nectaries clavate. *Siphocoryne.*
cc. Nectaries shorter than thick, or if a little longer, then the female has a hairy back. *Myzocallis.*
bb. Antennæ pilose.
e. Nectaries cylindrical, or at least twice longer than thick. *Cladobius.*
ee. Nectaries tubercle shaped, much shorter than thick, sometimes almost on a level with the surface. *Chaitophorus.*
aa. The seventh joint of the antennæ as long or longer than the sixth.
f. Species aerial; winged form elegant. *Pterocallis.*
ff. Species subterranean, winged form unknown.
g. The third joint of the antennæ longer than the fourth; hind tarsi one-jointed. *Trama.*
gg. Third joint of the antennæ as long as the fourth; hind tarsi two-jointed. *Paracletus.*

Sub-family II. LACHNINAE.

A. Sixth joint of the antennæ setaceous. *Sipha.*
AA. Sixth joint of the antennæ filiform or clavate, often ending in a spur, like a rudimentary joint.

a. Fourth vein of the fore wings nearly straight; stigma linear. *Lachnus.*
aa. Fourth vein of the fore wings curved; the stigma trapezoidal.
b. Abdomen bare.
c. Rostrum short, not extending to the middle legs. *Callipterus*
cc. Rostrum more or less long, extending at least to the hind legs. *Pterochlorus.*
bb. Abdomen wooly. *Phyllaphis.*

Sub-family III. PEMPHIGINÆ.

A. Cubital vein forked at the tip. *Schizoneura.*
AA. Cubital vein simple.
a. Hind wings with two oblique veins. *Pemphigus.*
aa. Hind wings with one oblique vein.
b. Wings deflexed in repose. *Tetraneura.*
bb. Wings horizontal in repose. *Aploneura.*

Sub-family IV. RHIZOBIINÆ.

A. Third joint of the antennæ much longer than the fourth. *Forda.*
AA. Third and fourth joints of the antennæ nearly equal in length. *Rhizobius.*

Sub-family V. TYCHEINÆ.

Only one genus in this sub-family. *Tychea.*

Sub-family VI. CHERMESINÆ.

A. Antennæ five-jointed.
a. Fore wings with four oblique veins; the cubital vein forked *Vacuna.*
aa. Fore wings with three oblique simple veins. *Chermes.*
AA. Antennæ three-jointed. *Phylloxera.*

Mr. Walsh, in his article on the Aphides, in Vol. I., Proc. Ent. Soc. Phila., gives the following synoptical table of the United States genera:

Synoptical Table of the United States Genera.

A. Honey-tubes present; antennæ seven-jointed; front wings with three discoidals, the third two branched; hind wings with two discoidals.
a Honey-tubes long; antennæ with joint seven longer than six.
b. Stigmal vein present. *Aphis.*
bb. Stigmal vein absent. *Calaphis.*
aa. Honey-tubes short, sub-obsolete; antennæ with joint seven longer than six.
b. Discoidals of the front wings of equal thickness; wings horizontally folded. *Callipterus.*
bb. Front wings with the first two discoidals more robust; wings steeply roofed. *Lachnus.*

AA. Honey tubes obsolete; antennæ short with not over six distinct joints, seven being obsolete or represented by a very small unquiculus attached to six.

a. Front wings with three discoidals, the third one-branched; antennæ six-jointed, sixth longer than the fifth.

b. Hind wings with two discoidals; wings roofed. *Eriosoma.*

bb. Hind wings with one discoidal; wings horizontal. *Thelaxes.*

aa. Front wings with three simple discoidals; hind wings with two discoidals:

b. Antennæ six-jointed, sixth nearly as long as fourth and fifth together. *Byrsocrypta.*

bb. Antennae six-jointed, four to six subequal, five a little the longest. *Pemphigus.*

aaa. Front wings with two simple discoidals; hind wings with one discoidal; antennæ with four or five joints? *Chermes.*

aaaa. Front wings with one one-branched discoidal; antennæ four or five-jointed? (three). *Phylloxera.*

He further designates these genera by the parts of the plant they operate on and their habits thus:

Aphis, foliage and roots. *Calaphis*, foliage. *Callipterus*, foliage. *Lachnus*, twigs. *Eriosoma*, twigs, limbs and roots. *Thelaxes*, galls. *Byrsocrypta*, galls. *Pemphigus*, roots. *Chermes*, foliage. *Phylloxera*, galls.

The following synoptical tables which I have prepared, are intended simply as aids to readers and others desirous of tracing genera and species. I confess that to a certain extent they must be considered artificial, but this I find to be the case with all I have examined. Buckton's arrangement is yet incomplete, and is wanting in reference to that portion of the family where the chief difficulty arises, reaching but partly through the *Aphidinæ.* Passerini's, the best complete synopsis we have, I consider defective in the following respects: It is based too exclusively on the number of joints in the antennæ; it distributes the root-feeding apterous species in different sub-families without sufficient grounds. The union of the *Schizoneurinæ* with the *Pemphiginae* is perhaps warranted in part by the similar habits of some of the species, but the marked distinction in the wing characters it seems to me justify the separation of the two groups at least as divisions of a sub-family if not as sub-families, as Buckton and Koch have done. It is evident that the two groups run into each other by such regular gradations that a rigid separation of the one from the other would require the separation of species of the same genus. The method I have adopted for the arrangements of these groups will be shown in the table of the sub-families.

SYNOPTICAL TABLE OF THE SUB-FAMILIES.

	(Sub-families.)
A. Winged form known; not subterranean except in a few cases where there are dimorphic forms.	
a. Front wings with three discoidal veins; antennæ of the winged individuals, and generally of the apterous individuals six or seven-jointed.	
b. Front wings with third discoidal vein twice forked (except in *Toxoptera*); posterior wings with two discoidal veins; honey tubes various.	APHIDINÆ.
bb. Third discoidal vein with one fork or simple; posterior wings with one or two oblique veins; honey-tubes tuberculiform or wanting.	PEMPHIGINÆ.
aa. Front wings with but two discoidal veins, the third being absent; antennæ never more than five-jointed, sometimes but three-jointed.	CHERMESINÆ.
AA. Permanently apterous, at least no winged form has been observed: chiefly subterranean, residing on the roots of plants.	RHIZOBIINÆ.

Synopsis of the Sub-divisions and Genera of Aphidinæ.

This sub-family may be conveniently divided into three tribes or sub-divisions as follows:

	(Tribes.)
A. Antennæ situated on frontal tubercles.	*Siphonophorini.*
AA. Antennæ not on tubercles.	
B. Antennæ seven-jointed, the seventh joint always longer than the sixth (except in some species of *Callipterus.*)	*Aphidini.*
BB. Antennæ six-jointed; the sixth joint often furnished with a spur at tip like a rudimentary seventh joint.	*Lachnini.*

Tribe *Siphonophorini*; (Genera.)

A. Third discoidal vein twice forked.
a. Honey tubes cylindrical, at least not clavate or enlarged in the middle, straight.
b. Honey tubes long, their length greater than their diameter, exceeding that of the tail and usually reaching beyond the tip of the abdomen.
c. Antennæ usually longer than the body; approximate at the base: front apparently grooved; first joint of the antennæ not toothed on the inside; honey tubes long. *Siphonophora.*
cc. Antennæ scarcely longer than the body; remote at base; first joint and tubercles toothed or gibbous on the inner side at the tips.
d. First joint toothed, and frontal tubercles gibbous internally; honey tubes long. *Phorodon.*
dd. Similar except that the first joint is not toothed; honey tubes moderately long. *Myzus.*
bb. Honey tubes short, but little more than tubercles, not exceeding the tail in length; antennæ not longer, and sometimes shorter than the body. *Hyalopterus.*
aa. Honey tubes clavate, enlarged in the middle, and usually long.
b. Honey tubes curved and usually, though not always, distinctly enlarged in the middle; antennæ longer than the body; tail inconspicuous or obsolete. *Drepanosiphum.*
bb. Honey tubes straight.
c. Antennæ longer than the body, at least in the winged form; tail large and conspicuous, (in our only species, frontal turbercle and first antennal joint gibbous). *Megoura.*
cc. Antennæ shorter, or scarcely longer than the body; tail small and inconspicuous. *Rhopalosiphum.*
AA. Third discoidal vein of the front wings with but one fork. *Toxoptera.*

Tribe *Aphidini.* Genera.

A. Honey tubes clavate; antennæ rather short. *Siphocoryne.*
AA. Honey tubes cylindrical, tuberculiforn or obsolete, but never clavate.
a. Seventh joint of the antennæ longer than the sixth or at least as long.
b. Antennæ pilose; honey tubes usually very short or obsolete; body also of apterous individuals often hairy or tuberculate. *Chaitophorus.*
bb. Antennæ smooth, rarely slightly pilose.
c. Honey tubes longer than thick, cylindrical. *Aphis.*
cc. Honey tubes tuberculiform or sub-obsolete. *Myzocallis.*

aa. Seventh joint of the antennae shorter than the sixth, or never longer; the veins of the wings often margined with a dark shading; honey tubes very short and sub-obsolete. *Callipterus.*

Tribe *Lachnini.*

A. Sixth joint of the antennæ setaceous without a spur at the tip. *Sipha.*
AA. Sixth joint of the antennæ filiform or clavate, often ending in a spur, like a rudimentary seventh joint.
  a. Abdomen bare; fourth or stigmatic vein of the front wings nearly straight, or slightly recurved; spur or sixth joint apparent. *Lachnus.*
  aa. Abdomen wooly; spur of the sixth joint wanting or minute. *Phyllaphis.*

Sub-family PEMPHIGINÆ.

A. Third discoidal vein of the front wing with one fork.
  a. Antennæ six-jointed.
    b. Hind wings with two oblique veins. *Schizoneura.*
    bb. Hind wings with one oblique vein. *Glyphina.*
  aa. Antennæ five-jointed. *Vacuna.*
AA. Third discoidal vein of the front wings simple: antennæ six-jointed.
  a. Hind wings with two oblique veins. *Pemphigus.*
  aa. Hind wings with one oblique vein.
    b. Wings deflexed in repose. *Tetraneura.*
    bb. Wings horizontal in repose. *Aploneura.*

Sub-family CHERMESINÆ.

A. Antennæ five-jointed. *Chermes.*
AA. Antennæ three-jointed. *Phylloxera.*

Sub-family RHIZOBIINÆ.

A. Antennæ seven jointed in the adult.
  a. Third joint of the antennæ longer than the fourth; hind tarsi one-jointed. *Trama.*
  aa. Third joint of the antennæ not longer than the fourth; hind tarsi two jointed. *Paracletus.*
AA. Antennæ six-jointed in the adult.
  a. Third joint of the antennæ longer than the fourth. *Forda.*
  aa. Third joint of the antennæ about the same length as the fourth. *Rhizobius.*
AAA. Antennæ five jointed, sometimes a minute rudiment of a sixth is seen, and sometimes the fifth is but rudimentary. *Tychea.*

Exceptional.—Koch describes a genus *Endeis*, with six-jointed antennæ, the first three joints very short, the fourth as long as these three. His figures show the three short basal joints, the long fourth and a fifth, but no sixth joint.

Remarks.—Passerini introduces into the first sub-family (Aphidinæ) as will be seen by reference to his synopsis already given, the following genera which are omitted, viz: *Cladobius* and *Pterocallis*. So far as I can see there is no good reason why the species of Koch's *Cladobius* might not be placed in *Aphis*.

The species placed in *Pterocallis* may as well be in *Callipterus* where Koch has placed them, and if a part of this group is brought into the tribe *Aphidini* all belonging to that genus should go with them. *Callipterus* evidently forms an osculent group between Aphidini and *Lachnini*, and I am of the opinion that it would be more in accordance with natural grouping to place it in the former than the latter. As *Trama* and *Paracletus* contain only apterous root-feeding species I have removed them to *Rhizobiinæ.*

In Lachnini, I have omitted *Pterochlorus* as I consider the long legs of the species for which it was founded insufficient to remove it from *Callipterus* where it belongs. If removed it should be placed in Koch's genus *Dryobius*.

I have adopted Passerini's generic name *Aploneura*, for the *Pemphiginae* with horizontal wings,—*Thelaxes* cannot be used here as it is described as having the third discoidal vein once forked.

Buckton, who has so far given to the public only his arrangement of the genera of *Aphidinae*, introduces between *Rhopalosiphum* and *Siphocoryne* a new genus,—*Melanoxanthus*, and next to *Chaitophorus* another genus *Cryptosiphum*.

I have not seen the description of these genera and hence cannot assign them positions in the table. Koch gives several genera which I have omitted as unnecessary and as not sufficiently distinct from other genera. *Amphorophora* Buckton is omitted as being without any real distinguishing characters. I am inclined to think if this genus was made to include the species of *Megoura*, making the form and length of the honey-tubes the chief character, it would be more natural and satisfactory than as they now stand.

A list of genera, with the names of North American species which may be considered as typical:

Genera.	*Typical species.*
Siphonophora, Koch.	Aphis rosae, Linn.
Phorodon, Pass.	Aphis humuli, Schrk.
Myzus, Pass.	Aphis cerasi, Fabr.
Hyalopterus, Koch.	Aphis pruni, Fabr.
Drepanosiphum, Koch.	
Megoura, Buck.	Megoura solani, Thos.
Rhopalosiphum, Koch.	Aphis persicae, Sulz.
Toxoptera; Koch.	
Siphocoryne, Pass.	
Aphis, Linn.	Aphis mali, Fabr.
Chaitophorus, Koch.	Chaitophorus populicola, Thos.

Genera.	*Typical species.*
Myzocallis, Pass.	Myzocallis hyperici. Thos.
Lachnus, Illig.	Lachnus salicicola, Uhler.
Callipterus, Koch.	Callipterus quercifolii, Thos.
Sipha, Pass.	Sipha rubifolii, Thos.
Phyllaphis, Koch.	Aphis fagi, Linn.
Schizoneura, Hartig.	Aphis lanigera, Hausm.
Glyphina, Koch.	Byrsocrypta ulmicola, Fitch.
Vacuna, Heyd.	
Pemphigus, Hartig.	Pemphigus populicaulis, Fitch.
Tetraneura, Hartig.	Aphis ulmi, Geoff.
Aploneura, Pass.	
Chermes, Linn.	Chermes pinifoliae, Fitch.
Phylloxera, Fonsc.	Phylloxera vitifoliae, Fitch.
Trama, Heyd.	
Paracletus, Pass.	
Forda, Heyd.	
Rhizobius, Burm.	Rhizobius lactucae, Fitch.
Tychea, Koch.	Tychea panici, Thos.

DESCRIPTION OF SPECIES.

In this part of my report the sub-families, tribes and genera will be arranged systematically according to the plan I have adopted; but no attempt will be made to arrange the species systematically, as I have not had an opportunity of examining sufficient material for this purpose. There are a few species introduced on the authority of other authors which I am unable to locate with certainty, not having seen specimens, these will be placed where they appear to belong with notice of the uncertainty in reference to their proper position.

SUB-FAMILY APHIDINAE.

This sub-family includes all the species possessing the following characteristics: The front wings with three discoidal veins, exclusive of the fourth or stigmatic vein at the apex; the third discoidal vein is twice forked (see Fig. 9) in all the species known, except those belonging to the genus *Toxoptera* where it has but a single fork (see Fig. 10); the posterior wings have two oblique or branch veins; antennae six or seven-jointed, the latter number being more usual than the former; the third joint longer than the fourth, fifth or sixth, and usually as long or longer than the seventh; the seventh generally setaceous and in many species as long or even longer than the third. Reproduction viviparous and oviparious; the oviparous female always apterous; all the species as far as known producing at some time winged individuals, (at least all those included as I have here arranged this group.) The number of species belonging to this division is very large, being the most extensive group in the entire family. On this account entomologists have endeavored to split up the old genus *Aphis*, which corresponded with this sub-family, into more limited genera.

FIG. 9.

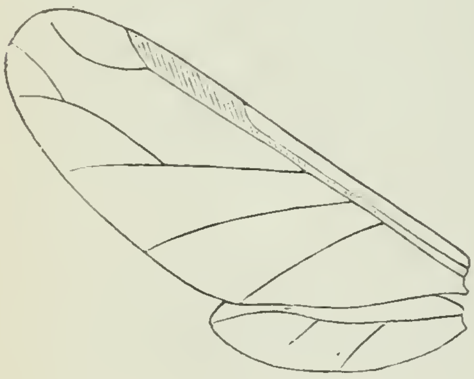
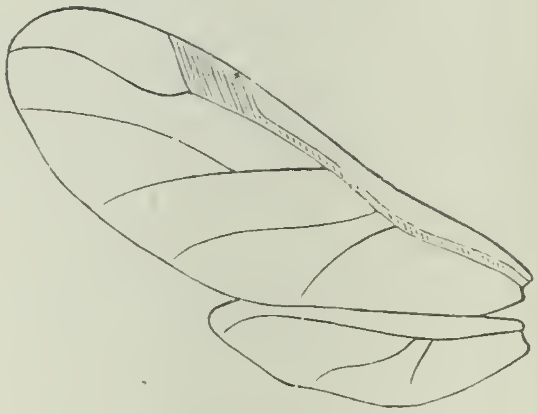


FIG. 10.



This has in some instances been carried too far, the characters selected being so trivial or indefinite as to render the generic distinctions of no value for scientific use.

Passerini, in his excellent papers on these insects began the reform movement by dispensing with some of Koch's numerous genera, and I have here attempted to carry it still further by combining some of his generic groups where the characters selected appear to be of little value.

Most of the species are aerial, and as a general rule reside on the leaves, tender twigs or branches of plants or on the stems of succulent plants. As examples of the group the following well known species may be named: the Grain Aphis, Rose Aphis, Hop Aphis, Cabbage Plant-louse, Apple Plant-louse, &c.

I think it more than probable that some of the species belonging to this sub-family are dimorphic and reside during the winter on the roots of plants; and it is possible that some which are now counted as apterous, root feeding species, are but other forms of true Aphides.

Buckton, who bases his sub-division into sub-families on the wing venation alone, includes in this group the *Lachninæ* of Passerini, but separates the sub-families into two sections corresponding with Passerini's *Aphidinæ* and *Lachninæ*.

I have followed him in combining the two groups into one sub-family, but have divided the sub-family into three sections or tribes: *Siphonophorini*, *Aphidini* and *Lachinini*, as shown in the preceding table. But this arrangement is not strictly followed out in the succeeding pages, which were written previous to this part of the report, and previous to the formation of the last preceding synoptical tables.

The species of *Aphidinae* (exclusive of *Lachnini*)* have the head small; eyes globular and somewhat prominent, and often in the winged individuals they have a distinct tubercle on the back part. The antennae vary considerably in length, being in some cases shorter than the body, but usually equaling or exceeding it in length; composed of seven joints, the first and second short and thick, their length seldom more than their diameter, the others slender and cylindrical; the third much longer than the first and second combined, and usually longer than either of the following; seventh slender and bristle-like, and usually much longer than the sixth. Beak of medium length or short, and standing out nearly perpendicular. Wings large, erect in repose; the front pair with the third discoidal vein twice forked (except in *Toxoptera*); the hind wings with two branch veins. The abdomen usually furnished with honey-tubes. The hind legs usually much longer than the others. The body always naked or nearly so, at least it is never covered with the downy or cottony substance found on the wooly lice.

They always operate on the surface of plants, never enclosing themselves in galls; being found chiefly on the leaves, tender twigs, branches or fruit stems, and are extremely common, being diffused on almost every kind of vegetation. They resemble each other so closely that it is very difficult to distinguish one species from another, hence the

---

*Note.—These characters apply more particularly to *Aphidinae*, as given by Pesserini, which includes, as set forth in my synoptical table, *Siphnophorini* and *Aphidini*. The characters of *Lachnini* are given hereafter.

older authors were in the habit of describing them by simply stating the plant and part thereof they infested. As a general rule, those that reside on leaves select the under surface, doubtless for the purpose of avoiding the rays of the sun and of escaping the observation of birds and other enemies. It is also probable that they find the underside of the leaf more easily penetrated by their slender setae than the upper surface.

The genera into which this sub-family has been divided have been already mentioned in the preceding synoptical tables.

There are three tolerably well marked sections in this sub-family which it may be of advantage to notice before entering the descriptions of species, as it will lessen the labor of assigning specimens to their proper genera and species. These divisions are briefly characterized in the preceding table.

Section 1. SIPHONOPHORINI.

The species of this section do not present such striking differences in form or habits to those of *Aphidini* as to attract particular attention upon a superficial examination, yet they are easily noticed by one who studies these insects somewhat carefully.

The chief differences between the two are these: the presence of frontal tubercles on which the antennæ are placed, which gives to the head, when seen from the side, a somewhat peculiar appearance bearing a slight resemblance to a goat's head. The antennæ are generally as long and often considerably longer than the body. The size of the body is usually larger than in *Aphidini*, and the legs are also rather longer.

The honey-tubes in the large majority of the species are long, sometimes equalling one-third the length of the body. The tail is also usually quite prominent. As a matter of course there are exceptions to most of these rules, but seldom if ever to more than one or two of them in the same species. The large majority of the species reside on the leaves of plants and mostly on those of a succulent nature, or on shrubs, few being found on trees, and in this case only on the leaves.

The insects of this group evidently form the highest types of the family, and should therefore be placed at the head.

Genus SIPHONOPHORA. Koch.

Beak of moderate length; last joint almost as robust as the penultimate. Antennæ seated on distinct frontal tubercles, very long slender and setaceous, at least as long as the whole body, and often considerably longer, extending in some instances to the tips of the closed wings. The two basal joints are short and thick; the third joint the longest, or at least longer than the fourth, fifth, or sixth, sometimes longer than the fourth and fifth combined; sixth usually shorter than the preceding one; the seventh bristle-like, much longer than the sixth and sometimes as long or slightly longer than the third. The frontal tubercles, on which the antennæ stand approximate each other, giving to the front of the head the appearance of being grooved. Honey-tubes very long, usually extending beyond the tip of the abdomen, and sometimes equaling in length one-third of the body, cylindrical and nearly always straight, never enlarged in the middle, or clavate. The tail distinct, more than usually long and large, generally curved slightly upward. Legs very long and slender. The wings erect in repose, the front wings with three discoidal veins and a forth or stigmatic vein: the third discoidal vein twice forked; the stigmatic vein curved and rather short. Hind wings with two oblique veins. All the species known present winged individuals. The males are always winged, the oviparous females is never winged: the winged individuals usually seen are viviparous females, the males being rare. The males usually have smaller abdomen, larger wings and longer antennæ than the winged females. The genus contains a large number of species.

Siphonophora Acerifoliæ. (Thos.)

Aphis, inhabiting the leaves of the soft maple.

I first observed this singular species on the leaves of the soft maple (*Acer dasycarpum*) Fort Dodge, Iowa, during the past summer. Subsequently I received specimens from Peoria collected by Miss Emma Smith, and from St. Louis, collected by Mr. Pergande. I am inclined to think it is quite commonly distributed wherever the soft maple is found, but has heretofore been overlooked. Although quite numerous it does not appear to be massed in colonies, but is found scattered over the leaves, somewhat resembling in its habits the Psylla, to which in fact it makes the nearest approach of any species of *Aphididæ* with which I am acquainted. Observed in the winged state September 1st and 2d.

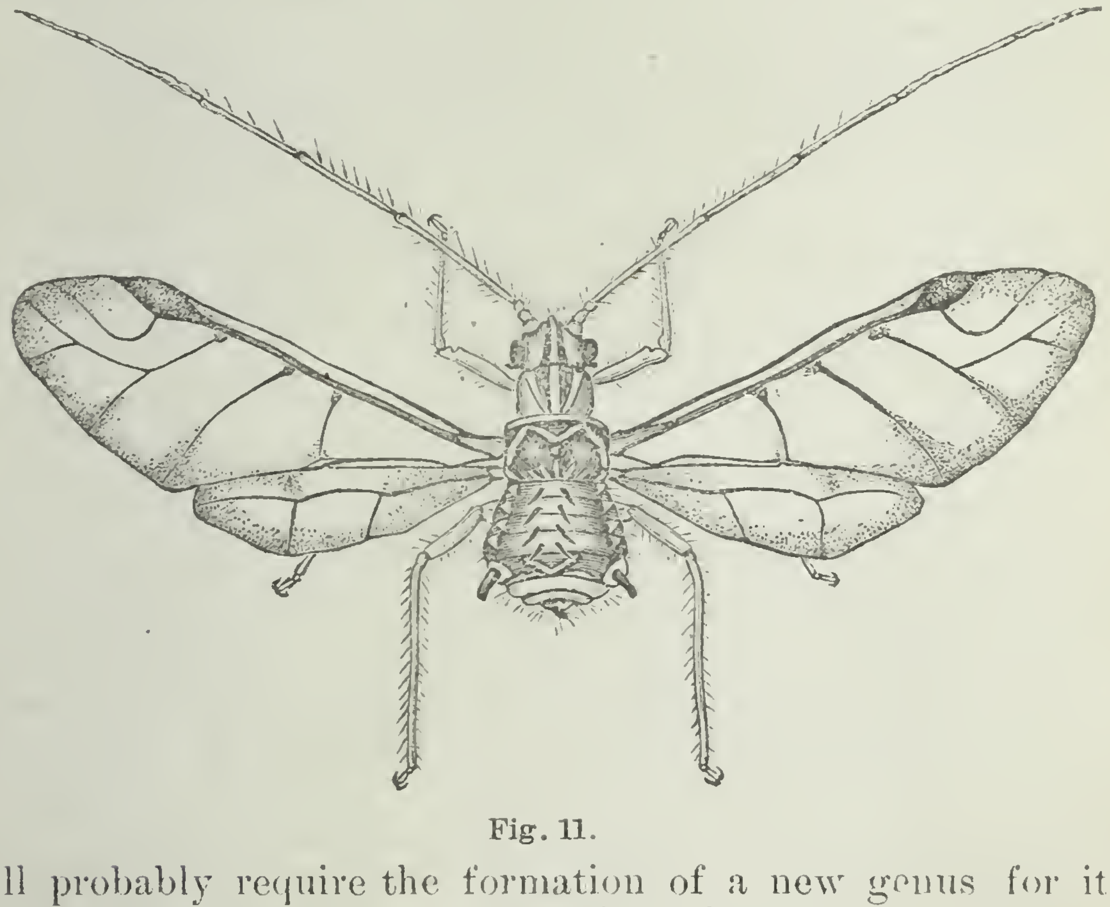


Fig. 11.

It will probably require the formation of a new genus for its reception, as it has some some strongly marked characters not found in other species of *Siphonophora*.

Winged individuals. (See fig. 11.) The general color is light gray varied white and ash brown. Antennæ on very distinct tubercles; very long, extending considerably beyond the end of the abdomen and reaching nearly or quite to the tips of the wings; third joint longest, fully equal in length to half of the body; fourth about two thirds the length of the third, fifth about as long as the fourth, sixth very short not more than one-fifth the length of the fifth, seventh nearly as long as the third, slender. Three ocelli, or what appear to be ocelli, very distinct, readily observed with an ordinary pocket lens. Prothorax depressed at the sides, forming a slight wing-like expansion each side.

From the back of each of the first three or four abdominal segments arise two distinct, slender, somewhat curved spines, those on the third segment usually the longest.

Honey tubes, rather short, not reaching quite to the end of the abdomen, distinctly enlarged at the base, and tapering to the tips; the enlargement at the base as seen from the side is abrupt. Wings large, the three discoidal veins of the front wings somewhat curved inwards, the second most so; the second rather nearer to the third than to the first, especially in the middle and thence to the margin; the fourth or stigmatic vein very strongly and sharply curved near the base. Most of these veins, especially the fourth and the forks of the third, expand at their extremities, forming dusky spaces which present a very marked character. The sub-costal vein is strictly parallel with the costa. Stigma short and rather small. The hind wings small and delicately transparent, veins minute and pale; the sub-costal bends inward or backward quite distinctly and abruptly at the point where the second discoidal joins it, leaving a triangular space between it and the costa in which there is a distinct, abbreviated, transverse, dark line or elongate dot, pointed directly toward the insertion of the second vein. Basal joints of the antennæ dull-yellowish, with a narrow darker ring at the apex of the third and forth joints; more or less of the fifth of a transparent whitish color, forming an annulus, sixth and seventh dusky. Legs pale. General color of the body pale grayish-brown in dead specimens, but the specific markings of living specimens are as follows; Head pale brownish with a narrow white median line, and sometimes a white line around the eyes above. Eyes red. Prothorax same color as the head, with three more or less distinct, very narrow abbreviated, longitudinal, white lines; abdomen marked with a few white dots somewhat regularly arranged, powdered with white behind the honey-tubes. These white lines and spots appear to be formed by a very fine white powdery substance. The spines on the back of the abdomen are black or pale at base and black at the tip. The honey-tubes brown, white at the immediate tips.

Wingless Specimens. (Not fully grown.) A very pale transparent, pea green color; eyes dark; apica portion of the antennæ dusky; tibiæ dusky at the base; honey-tubes pale green. The form is oblong, widening slightly posteriorly, tip of the abdomen rounded; no powdery substance apparent on them; on the contrary the surface is smooth and shining. They are located chiefly along the sides of the larger veins on the under side of the leaf.

In the living winged specimens, the dusky expansions of the veins show very prettily, and the stigma appears to be transparent in the central part with a broad dark border encircling it behind.

When in motion, these insects are more active than usual, moving quite rapidly and often taking quite distinct leaps, yet their hind legs are not unusually elongated. Slightly above medium size, but less than *S. rudbeckiæ.*

Although these insects are not numerous on any one leaf—the young sometimes forming small colonies, but adults always scattered—yet the effect of their operations is often very apparent, giving the leaves a shriveled or sickly appearance. It is possible therefore that this species may, under favorable circumstances, develop to such an extent as to seriously injure the Soft Maples so common in the Northern and Middle portions of our state.

Insect enemies.—I find preying upon this spécies the larva of a Syrphus fly, which I have been unable to trace to the perfect state. It is of a greenish color, the front portion pale, whitish at the immediate front and becoming greener backwards, the hinder portion being quite green, shaded with fuscous. There is a row of tubercles along each side near the stigmatic line, one tubercle on each segment, from which arises a black hair; there are also besides these, three longitudinal rows of black hairs, one median and one on each side between the median line and line of tubercles--one hair in each row to each segment.

This plant-louse appears to be quite distinct from *Aphis aceris* Linn, which according to Dr. Fitch occurs on *Acer Pennsylvanicum.*

SIPHONOPHORA RUDBECKIÆ. Fitch.

I have had an opportunity during the past summer of examining a large number of specimens of this species in all stages. It appears to be very closely allied to if not identical with *A. solidaginis* of Fabricius and other European authors, the color of the thorax of the winged specimens presenting the only perceptible difference.

I find it not only on the Golden rod, and the *Rudbeckia laciniata* but also on the Rag-weed (*Ambrosia trifida*,) and often in immense numbers on the flower stalks and tender stems. It is quite common in Illinois. It is very active and often wanders off to other plants besides those which it usually attacks, but so far I have failed to observe it on any useful plants.

Winged viviparous female.—Size very large, the length of the body varying from .12 to .14 inch; to the tips of the wings .20 inch. Body of a dull orange red or pale reddish brown color thoughout. Antennæ, eyes, honey-tubes and legs (except the base) black. Antennæ long, tapering, the length slightly exceeding that of the body, of a dusky black throughout except the basal joint and tubercle, which are of the same reddish color as the body; when examined with a microscope they are found to have strong hairs on them which appear to be placed alternately on opposite sides somewhat regularly; the seventh joint much longer than the sixth, the sixth not more than half the length of the fifth. Honey tubes long, cylindrical and black, extending beyond the tip of the abdomen and equal in length to one-fourth the body. Legs very long and slender; black, except the basal half of the femora which is yellow; the posterior pair is unusually long. The wings are comparatively large, of a transparent greenish-yellow tint; the sub-costal vein or mid-rib runs close to and strictly parallel with the costal vein; the venation very regular, complete and typical, except that the third discoidal vein is sometimes obsolete at its immediate base where it connects with the mid-rib.

I find that there is a variety differing very materially in color, and which would probably be taken for a different species. In this variety the parts which are red in the other, are of a bright green, the markings in other respects being alike. I am satisfied it belongs to the same species as I find the two colors in the same colony in all stages of growth. The wingless specimens of this variety are also of an apple green. The green and red larvæ can occasionally be seen mingled together in the same colony.

The cauda or tail is acute and rather long. The beak reaches nearly to the insertion of the posterior legs; is pale at base, the apical half dusky.

This species has a very common habit of placing itself on the stems of the plant it inhabits with the head downward.

SIPHONOPHORA AMBROSIÆ. Thomas.

About the first of last September, while in Sioux City, Iowa, I found in great abundance on the leaves and tender stems of *Ambrosia psilostachya*, a species which at the time I supposed to be *S. rudbeckiae*, but subsequent examination of the specimens led me to doubt this conclusion and hence I described it as new.

Similar in size and general appearance to *S rudbeckiae* but varying in color from a light brown to a dark seal-brown. The discoidal veins of the front wings strongly curved, being much closer together at their base than at the margin of the wing; the third obsolete for a short distance at its base. Antennæ long, passing the tip of the abdomen, light brown, dark at the tip, seventh joint longest, third about two-thirds the length of the seventh, the sixth not more than one-fourth the length of the seventh. Honey-tubes long, cylindrical, reaching beyond the tip of the abdomen. Tail long and pointed. The body of the wingless specimen appears to be covered with tubercles out of which proceed hairs, some specimens appear to have these hairs knobbed at the tip. The winged specimens do not appear to be tubercled, but the antennæ have on them alternate hairs which in the specimens examined appear under a high power to be knobbed or capitate at the tips. A similar characteristic has been noticed by Buckton in *Myzus ribis*, a species found on the Red Currant and the Gooseberry

Honey-tubes dark or the same color as the body; tail yellowish-brown Beak dark at the tip reaching to the third coxae.

SIPHONOPHORA ROSÆ. Reaum. The Rose. Aphis.

I had hoped that this season I would be able to procure specimen of this species, but have been disappointed, only a single specimen having been found, and this wingless and doubtful. Therefore, supposing our species to be identical with that found on the rose in England, I will give briefly the characters and history as found in the writings of English and other European entomologists. The wingless viviparous female is about one-eighth of an inch long, of an elongate ovate form; shining green or reddish; antennæ as long or longer than the body; honey-tubes long, reaching beyond the tip of the abdomen; tail prominent, yellow; eyes red, legs long, yellowish green, with black knees and feet. The winged female has the head and thorax shining black; eyes red; antennæ longer than the body, dark; abdomen green, with about five black dots on each side in advance of the honey-tubes and usually two short transverse black bands behind them; tail yellow, hairy; wings large, sub-costal vein yellowish, other veins dark, stigma greenish; honey-tubes black.

There is also a reddish brown variety, the species being quite variable. They are found on the tender shoots, leaf-stalks and flower-stalks of the rose, especially the last, where they sometimes congregate in large numbers.

There is also another species which infests rose-bushes in Europe, which is quite distinct from that just described. This is the *Siphonophora rosarum.* Koch—and is easily distinguished from the former by its shorter antennæ, shorter honey-tubes and legs, and by the body of the wingless female being studded with tufts of hairs. I am not aware that this species has been seen in this country, though it is quite possible it is found here.

SIPHONOPHORA AVENÆ, Fab. The Grain Aphis.

This species, which has long been known on wheat, oats, barley and rye, has doubtless been imported from Europe, where it has been described under various names, as *A. avenæ*, Fabr.; *A granaria*, Kirby; *A.cerealis*, Kalt., and *A. hordei*, Kyber. Occasionally of late years, t has become quite too common upon the wheat crops of our Illinois armers, sometimes considerably affecting the yield of this cereal. In 866 it appeared in various parts of the state in sufficient numbers to do considerable damage; and again in the fall of 1876 it made its appearance on the young wheat in Illinois.

They are seen during the season in three different forms, the wingd females, the wingless females, which are far more numerous than he winged ones, and the young wingless larvæ. Pupae, with minute udimentary scale-like wings, may also occasionally be seen. They re furnished with moderately long honey-tubes, and the females have lso a distinct ovipositor or tail-like process at the end of the body; he males are destitute of this process.

In England according to Curtis, this species presents the following haracteristics:

The wingless female varies in color, being red, green, brown or yelow; the front is convex in the middle, with a distinct lobe on each ide; antennæ black, nearly as long, or longer, than the body; knees, arsi and tips of the tibiae, black.

Winged female brown, rarely green; abdomen with a row of black dots on each side, tip yellow; wings pellucid; veins pale yellow.

Buckton, the latest English authority, describes the viviparous wingless female as subovate, wholly green or brownish green; frontal tubercles moderately large; honey-tubes shining brown, long and thickened at the base; tail large, yellow and recurved; eyes red. The winged female—general color pale brown or rust yellow; thorax brown; abdomen ovate, broad and shining green ; honey-tubes black ; antennæ longer than the body, frontal tubercles not large; legs ochreous with black knees and feet; tail yellow, ensiform and hairy.

In France, as described by Goureau, the wingless individuals ar one-tenth of an inch long, green; eyes, tips of the antennæ, of th femora and of the tibiae, black. Winged specimens one-sixth of a inch to the tips of the wings; head and thorax a testaceous yellow abdomen, green; wings, transparent, with a brownish band betwee the border and the sub-costal vein; rest as apterous individuals.

Dr. Fitch describes the winged female as follows: "It is 0.10 lon or to the tip of the closed wings 0.20 of an inch. Head transverse, con vex in front, rectilinear at base, dull pale yellow. Eyes jutting ou from each side of the head, globular, usually of a rusty reddish colo Eylets or ocelli three, appearing like minute glassy dots placed at th angles of an imaginary triangle, far apart, one near the upper edge each eye, and the third one forming a slight projection upon the mi dle of the forehead. Beak pressed to the breast, arising between th base of the fore legs and reaching half way to the middle legs, pa green, its tip black. Antennæ long and slender, about equaling th body in length, tapering, black, their bases obscure yellowish, seve jointed. Thorax nearly globular; collar much narrower, narrowing fo ward, a little longer than the head, grass green; remainder of th thorax dull, pale yellow and shining above with a large egg-shape black or brown spot on each side, between the forward ends of the spots a small oval one, which reaches forward to the collar, these thr spots being elevated, convex and polished; sides beneath the win sockets, with an oval brown spot, paler than those on the back, a placed obliquely. Breast dull black betweeen the four anterior le and often dusted with a glaucous powder. Scutel dull pale yello appearing as an elevated, smooth, transverse ridge of semi-circul form above the base of the abdomen. Abdomen broad oval, round at tip, grass green, with a row of about three blackish dots on ea side forward of the base of the honey-tubes. Honey-tubes black, long as to the tip of the abdomen, slightly thicker towards their ba Tail very pale greenish yellow, straight along its upper, and convex its under side. Legs long and slender, hind pair longest; thighs ve pale greenish, towards their middle becoming yellowish, and beyo this black; shanks bearded with fine short hairs, pale dull yello their tips black. Feet short and slender, but half as thick as shanks, obscurely two-jointed and with two small claws at their e Wings held together in a steep roof over their body, transparent, w slender brown veins, the rib-vein thick and sulphur yellow, as is stigma spot also, the veins bounding its two sides being brown; in edge with the customary blackish streak extending forward for a sh distance from the tip of the first vein. First and second veins m than twice as far apart at their tips as at their bases. Third vein ar from the second at its origin as this is from the first, nearly par- lel with the second vein, very slightly farther from it at its tip than t its base, its fork given off forward of its middle, and this fork ending off the second one beyond its middle. Tip of the first fork vice as far from the tip of the third vein as from the second fork. ourth vein strongly curved through two-thirds of its length and then traight and parallel with the second fork, its tip nearer the tip of the cond fork than this is to the first fork, and almost twice as far from e tip of the rib-vein as from the second fork."

"In the spring, before the heads are formed on the grain stalk, they ve singly scattered over the leaves and stalks, the young lice as soon s they are born wandering away from their parents without any ap arent disposition to form colonies. But as soon as the heads begin appear, these insects, led by mysterious instinct. forsake all other arts of the plant and congregate upon the heads, fixing themselves, ead downwards upon the base of the chaff which envelops the ker- el. Now the young lice, instead of wandering away, fix themselves compact colonies around their parents. This change in habit, it is serted, is accompanied by a change in color, that while feeding on e leaves they are grassy green, but when they change to the heads ey gradually acquire an orange color, and ultimately change to the lors mentioned."

But so far as those found on the leaves and stalks are concerned, e description given does not appear to be uniform, for I found upon e wheat in the winter of 1875, living specimens, winged and apterous. he apterous specimens are more or less brownish, thus agreeing ith the characters given by Curtis. The winged specimens before e agree with Dr. Fitch's description, except that the head is shining ack; the antennæ nearly as long as the body, not pale at the base; e front of the thorax greenish-yellow, back of the thorax black, rest reenish yellow; honey-tubes do not quite reach the tip of the abdo- en; wings perfectly pellucid; the rib vein a nearly transparent hon- y-yellow, rest of the veins colorless. The arrangement of the veins rresponds with that given; the abdomen greenish-yellow, slightly- ecked with fuscous in addition to the lateral spots.

But this is undoubtedly the species now under consideration, as is own by the form of the head and thorax, the oval elevated spots n the thorax, venation of the wings, and other undoubted characters. his identification, which fortunately I am now able to make, enables e to add something to the history of the species. When the winter heat appears above the ground in the fall, it passes from its hiding lace at this time, wherever that may be, probably in the same way at it does from the winter wheat to the spring wheat and oats in e spring, that is by the winged individuals.

Here they work upon the leaves and stalks singly, while the weather not too cold, but when winter appears they move down towards the round, some of them, at least, entering the soil and feeding upon the p of the roots. At any rate, I find the apterous ones at this time orking upon the roots, but at the same time I find a winged indi- idual above ground. I have also observed them heretofore at the root f the wheat, late in the winter, while snow was on the ground; and hat somewhat surprised me, I found them busy at work under the ow, and the apterous females bearing well formed larvae. I am, erefore, led to believe that in this latitude the species passes the winter in other than the egg state. This will also, probably, be found true wherever winter wheat is grown.

The following account of the operations of this species in England is taken from Buckton's "Monograph of British Aphides"

"Early in the year the young aphides absorb sap from the blade close to the stem, but later they attack the ears in vast numbers, inserting their rostra close to the junctures of the grains with the stalk. Sometimes as many Aphides are present as there are grains in the ears.

"Doubtless the injury done is not so much from the quantity of nutritive sap which they withdraw from the plant as from the incessant irritation produced by the punctures of the sucking apparatus. A sickly condition and a yellow color are soon induced upon the corn plants; but, just as the hop crop is often saved by the appearance of swarms of *Coccinellidæ* and other checks to Aphides, the wheat crop is often saved by the operations of certain minute *Ichneumonidae* and *Chalcididae.*

"If the ears of wheat be searched early in the month of July, very probably a number of dead or dying insects will be found fixed singly at the base of each grain, with their heads usually turned downwards. These insects, which are of a rich brown or sienna color, are the pupæ of *S. granaria* which have been struck by a small, black, winged fly (*Ephedrus plagiator?*). These parasites may be obtained without difficulty if some of the blighted wheat ears are preserved under a bell glass, when they emerge from the round holes they cut in the Aphis pupæ. They possess attenuated shining bodies, long hairy legs, and many jointed antennæ. The insects appear very large when referred to the empty skins within which they have undergone their metamorphosis

"If the cornfields be again searched a little later in the month, another insect of a different genus will be seen running with excitement over the wheat ears, and tapping with its rapidly vibrating antennæ the pupae already struck by the *Ephedrus* before mentioned. One of the ears was placed under a microscope of low power for observation. Notwithstanding this novel situation, the winged insect, which was identified with *Ceraphron Carpenteri*, Curt, was too much interested in its work to suspend its operation. After the *Ceraphron* had satisfied itself that a pupa had not been previously tampered with by one of its own species, it turned the apex of its abdomen towards the abdomen of the Aphis, and then bent the points of its antennæ so as to form a fulcrum, like a knee-joint against part of the wheat ear. A fine but short ovipositor was then extruded, and by means of a peculiar sawing motion was finally thrust through the hardened skin of the Aphis pupa.- This motion was continued for ten minutes at least, and even after the insect was .pierced, during which operation probably the larva of the *Ephedrus* was stung and made insensible. Finally the *Ceraphron* introduced its own egg, from the grub of which eventually come the destruction of the larva of the parasite, which first attacked the larvae of *Siphonophora granaria.*"

This species operates not only on wheat, but also on oats, barley and various grasses. During the past spring (1878) these insects were quite abundant in Southern Illinois on the wheat, and caused consider able alarm among the farmers, but fortunately they were destroyed by heavy rains.

SIPHONOPHORA VITICOLA. Thos. The Grape-inhabiting Aphis.

In the latter part of June, Prof. French sent me some leaves of Clinton grape-vines infested by this species, which he found at Irvington, in the southern part of this state. The next day I was fortunate enough to find the same species on one of my own vines. Not numerous, it is true, but in sufficient numbers with a favorable season to do the vines considerable injury. They were found on the young and tender leaves and stems near the ends of the young branches.

Whether this is the *A vitis* of Scopoli or not I am unable to say, as I have not seen the description of that species.

Wingless-females.—Strongly ovate in shape, broad behind, and about .08 of an inch long. Of a dusky-brown color, somewhat paler in front. Antennæ of the usual form in this genus, but scarcely as long as the body. Honey-tubes very long, slightly curved and slightly enlarged at the base, cylindrical and fully one-fourth of the length of the body. Legs rather long but not to the same degree as in *S. rudbeckiæ.*

Honey-tubes, legs and antennæ black except that there appears usually to be a broad, pale annulus on the antennæ near the base, and in many specimens there are also several pale rings. The tibiae of the front legs have the upper half pale. Tail distinct.

Winged-female.—Very similar in appearance to the wingless, somewhat slenderer; front parts darker, the head and central parts of the thorax dark brown. The second discoidal vein more than usually distant from the third; stigma dusky or brown, elongate, sides parallel, pointed at the tip. Length of body same as wingless.

The following notes in reference to this species were kindly furnished me by Prof. French.

"About the 25th of June they first began to appear on the ends of the twigs of the Clinton grape-vines, working at first only a few inches down from the end. They spread rather rapidly over the twigs, so that in the course of two or three days they were on a dozen or more. By this time the larvæ of a Syrphus and a Chrysopa had found them and were at work upon them. By July 10th the lice had spread over the vines along one side of a walk, which is bordered on both sides by a mixture of Clintons and Concords, yet working on the Clintons only. They appeared to work mostly on those twigs in the shade of some neighboring peach trees. July 14th a further examination showed that more twigs were infested than before, some twigs were covered as far down as twelve or fifteen inches from the tips."

During the past season (1878) I had an opportunity of observing this species somewhat carefully, I found almost every colony ruthlessly attacked by a species of *Aphidius*, which in a short time destroyed all on my vines.

SIPHONOPHORA SETARIÆ. Thomas. The Bottle-Grass Aphis.

This species was found in August on the heads of a species of bristly Fox-tail grass, usually known as Bottle Grass (*Setaria glauca.*) These plant-lice appear to confine themselves to the heads, feeding on the rachis and on the little fruit pedicels. Occasionally they wander to the stems and even to the leaves. What appears to be the same species, was found about the same date on the heads of the Cocks-comb grass (*Panicum crus-corvi*).

Pupa.—Somewhat oval in form, width about two-thirds the length. Length about .05 of an inch. Antennæ nearly as long as the body, seventh joint about equal in length to the third and fourth; without hairs. Honey-tubes slightly enlarged at the base, cylindrical, reaching nearly to the tip of the abdomen; tail distinct, conical, about as long as the width of the preceding segment, rather broad. Wing-pads distinct.

General color brown or brownish with a slight olive tint; first and second joint of the antennæ dusky, third and fourth bright yellow, apex dusky; eyes black; wing-pads greenish at the base.

Wingless female.—Honey-tubes extending slightly beyond the tip of the abdomen, black; tail white; legs yellow, except the joints and tarsi which are dusky, the femora are generally white at the base, growing darker toward the apex. Antennæ nearly or quite as long as the body, marked as in the pupa except that the light portions are clear white. Beak reaching nearly to the hind coxae, pale and apparently slightly enlarged at the tip.

Winged females.—Antennæ similar to that of the wingless specimens, except that they are a little longer, the third, fourth and fifth joints being slightly elongated but bearing the same proportion to each other as in the pupa: third joint, under a strong magnifier, shows very distinct glassy or cicatrized spots. The mid-rib or subcostal vein of the forewings is stout and runs parallel with the costal vein; the three discoidal veins about equally distant from each other at the base; the first slightly curved inward toward the base of the wing as it approaches the hind margin; stigmatic vein regularlycurved; stigma fusiform, prominent and opaque, of a brown color. Wings transparent. General color similar to that of the pupa.

The wingless specimens found on cockscomb grass differ only, in being of a lighter color—pale uniform plum color; and in having a distinct tubercle on each side of the neck; tail rather more elongate and narrow. The other markings, which are strongly characteristic, are the same, and hence I think this is not a different species.

SIPHONOPHORA EUPHORBIÆ. Thos. The Spotted-Spurge Aphis.

This and the next species were obtained at Sioux City, Iowa, when I was there about the first of September. By some means I have lost the note I made in reference to its color and hence can only give the following imperfect description from the alcoholic specimens. I remember feeling quite confident at the time the two were discovered that they were very distinct species, although this was similar in color to the other, both being pale green.

Found on *Euphorbia maculata.* Antennæ longer than the body, very slender; the third and seventh joints very long; a few regularly placed hairs. Honey-tubes long and slender, reaching beyond the tip of the abdomen, nearly one-third as long as the body, cylindrical. Tail very distinct, ensiform and slender, about half the length of the honey-tubes. Wings with the sub-costal vein somewhat robust, diverging as it leaves the base so as to leave the widest space between it and the costal vein opposite the insertion of the first discoidal vein, then approaching until it reaches it at the stigma; stigma elongate fusiform with the outer end long and pointed; third vein obsolete at the immediate base.

The specific name *euporbiae* has been previously used in *Aphis*, but as this comes in *Siphonophora*, where the name has not been heretofore used, it will cause no confusion.

SIPHONOPHORA EUPHORBICOLA. Thos. The Margined—Spurge Aphis.

Found September 1st., 1877, at Sioux city, Ia., on *Evphorbia marginata.*

Winged female.—Antennæ long and slender, exceeding the body in length; legs very long and slender; general color a pale pea-green; honey-tubes very long, reaching beyond the tip of the abdomen, equal in length to about one-fourth of the body; wings very large and transparent. Head pale glaucus, the two lateral ocelli very prominent; eyes dark; antennae dusky except the basal joints and the base of the third joint which are pale. Thorax with a slight purplish tint, prothorax green, abdomen pale green, legs hyaline except the knees and tarsi. Honey-tubes pale green at base, dusky at the tip; tail long, sword-shaped, slender, curving upwards, about half the length of the honey-tubes, greenish. Wings with slender but very distinct veins, which are dark or brownish except the costal and sub-costal which have the basal portion pale; veins very straight except the stigmatic which is strongly curved; stigma elongate, narrow and pointed at the ends, with the sides parallel. Beak extending to the hind coxae.

Antennæ similar to those of *S. rudbeckiae* with a few regularly placed alternate hairs.

Length to tip of the body .09 of an inch; to tip of the wings .15 inch.

Wingless females.—Pale green throughout except the eyes which are black; the antennæ dusky except at the base; tips of the honey-tubes and the tarsi dusky; legs pale, transparent.

I noticed a number of specimens which were covered over, especially on the abdomen, with rounded tubercles, and with minute short hairs or cottony scales. These I took to be sexual differences.

This species is very closely allied to *S. cyparissiae* Koch., but is distinct, as that has red eyes.

It was quite abundant on the leaves and tender stems of *Euphorbia marginata.*

SIPHONOPHORA ASCLEPIADIS? Fitch. Milkweed Aphis.

Found at Fort Dodge, Iowa, September 1st, on the leaves of the large Milkweed (*Asclepias cornuti*,) generally on the under side, or on the upper side, near the base of the leaf. They are generally found near the top of the plant on the young and tender leaves.

I give this as identical with the species described by Dr. Fitch with some doubt, if it should be different it may be named *S. asclediadifolii*. I herewith present Dr. Fitch's description.

"It inhabits the under surface of the leaves of the common Silkweed. Black; abdomen pale green; two rows of compressed dusky dots on each side, three in the lower and five in the upper row; honey-tubes nearly reaching to the tip of the abdomen; veins of the fore wings brown, the costal or marginal one whitish; stigma smoky-white. Length, 0.15 inch."

Wingless females.—About medium size; antennæ nearly as long as the body; honey-tubes reaching beyond the tip of the abdomen, largest at the base, cylindrical. The general color very dark green, many so dark as to appear black, but usually the green shows distinctly on the abdomen, the true color appearing to be green or dark green with dusky shadings; under side dark green; antennæ transparent whitish, except near the tip where they are dusky; legs clear, transparent white, except the tarsi, which are black; honey-tubes black; tail distinct, but short slender and apparently dark green. Body ovate and convex.

The young larvæ are pale greenish. Those which will acquire wings are easily distinguished from other larvæ while quite young, being more flattened on the back, more elongate and oval in shape and the honey-tubes are not more than half the length of those of the apterous viviparous females. These and the pupæ they produce are yellowish or orange colored, sometimes greenish.

Winged individuals.—Found with the above, and as I am fully satisfied belonging to the same species.

Antennæ a little shorter than the body, reaching about to the base of the honey-tubes; the tubercles on which they stand have the inner margin more than usually prominent; the third joint shows a few pustulous spots. Front between the antennæ appears to be prominent and almost pointed; the tubercle on the hind portion of the eye very prominent. Honey-tubes cylindrical, reaching beyond the tip of the abdomen, length about one-fifth that of the body; tail distinct but not very prominent, somewhat narrow and conical, not more than one-fourth as long as the honey-tubes. General color yellow or greenish yellow. Antennae dusky, third joint pale at the base; head dark; neck yellow; thorax dark above and beneath; abdomen yellow; honey-tubes dusky in the middle, paler toward the base and tips; tail yellow; the tips of the tibiae and tarsi dark.

SIPHONOPHORA ERIGERONENSIS. Thos. Aphis of the Canada Flea-bane.

Found during August at Carbondale, Illinois, on the flower stalks of the Canada Flea-bane (*Erigeron Canadense*). Observed first August 16th, some were then in the winged state; again noticed August 28th.

Winged female.—Green; the antennæ, eyes and honey-tubes black. Antennæ as long or rather longer than the body, the seventh joint scarcely as long as the third, but this relative length does not appear to be uniform; third joint slightly pustulate, with a few hairs regularly placed; very similar to the antennæ of *S. rudbeckiae;* first and second joints pale greenish yellow, rest dusky.

The eyes black with the usual posterior tubercle. Beak moderately long, pale except at the extreme tip which is black. Honey-tubes very long, cylindrical and stout, slightly thickest at the base; extending beyond the tip of the abdomen, and nearly equal one-third the length of the body; deep black throughout. Tail distinct, rather slender, narrow at the base, slightly enlarged in the middle, curved upward and pointed at the apex. Legs long and slender, black except the basal half of the thighs which is transparent green. The head and thorax are a deeper green than the abdomen, which has a yellowish tint.

The young are pale greenish yellow; the full grown wingless females a light pea-green, with sometimes a deeper-green area in the middle part of the abdomen above. The tail, in the apterous individuals, is slender and ensiform; and about one third the length of the honey-tubes.

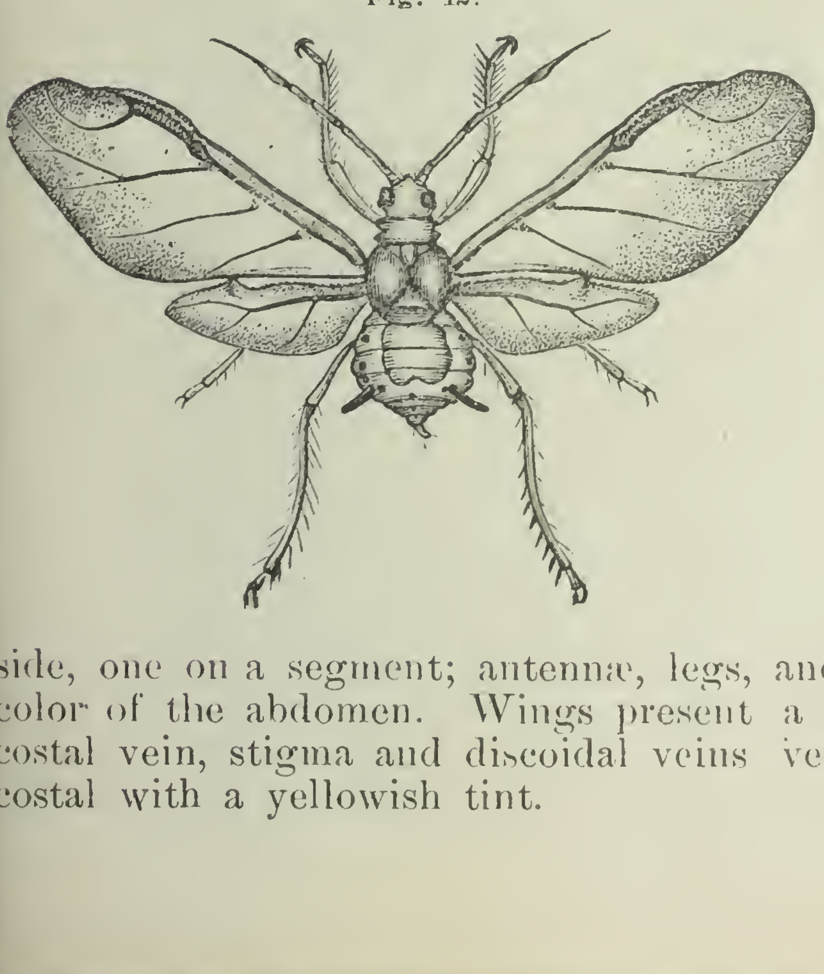
Length of winged individual .08 inch, to tip of the abdomen; .13 inch, to tips of the wings.

Siphonophora coreopsidis. Thos. Aphis of the Spanish Needle.

Found by Mr. Th. Pergande at St. Louis, Mo., in October, on the heads and flower stalks of Spanish needles (*Coreopsis aristosa*). I am not absolutely positive as to the species of plant, as only a little fragment was sent of the head, but am satisfied that it was a species of *Coreopsis*. I ascertained nothing further in reference to the habits of the species.

Winged individuals—(Fig. 12.) Antennæ about two-thirds the length of the body, joints proportioned as usual. Honey-tubes long and cylindrical, length equal to about twice the distance to the tip of the abdomen. Body elongate, oval, not tapering. Subcostal vein of the front wings robust, parallel with the costal, the other veins slender and delicate. Head and thorax black; abdomen greenish yellow with a grass green spot on the back next the thorax, and three green spots along each side, one on a segment; antennæ, legs, and honey-tubes black; tail the color of the abdomen. Wings present a slightly smoky appearance; costal vein, stigma and discoidal veins very dark—almost black; subcostal with a yellowish tint.

Fig. 12.



Wingless individuals—(Figs. 13 and 14.) Head pale yellow; thorax yellowish green; abdomen greenish yellow with a grass-green streak running from the thorax to the tip of the abdomen; also one running across near the thorax; the hind margin of the abdomen from the base of one honey tube to the other, is of a reddish tint. Eyes black; wing cases of the pupa black. Fig. 14 shows to the right a highly-magnified view of the right eye; at the top is an enlarged figure of an antenna.

Fig. 13.

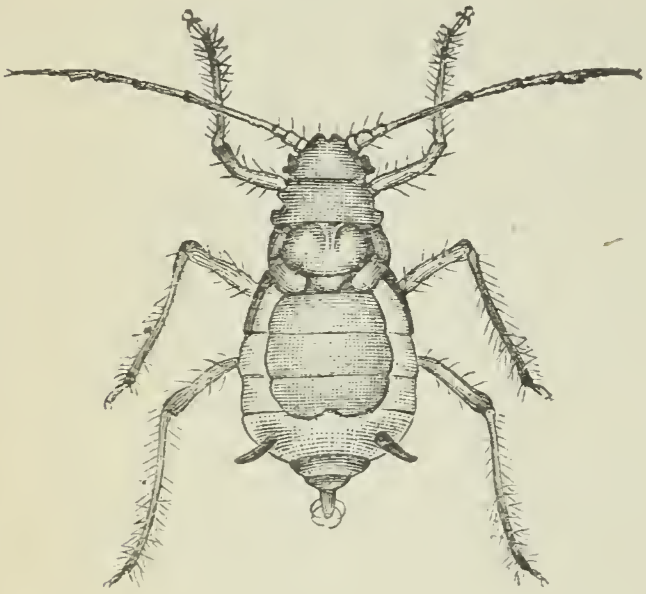
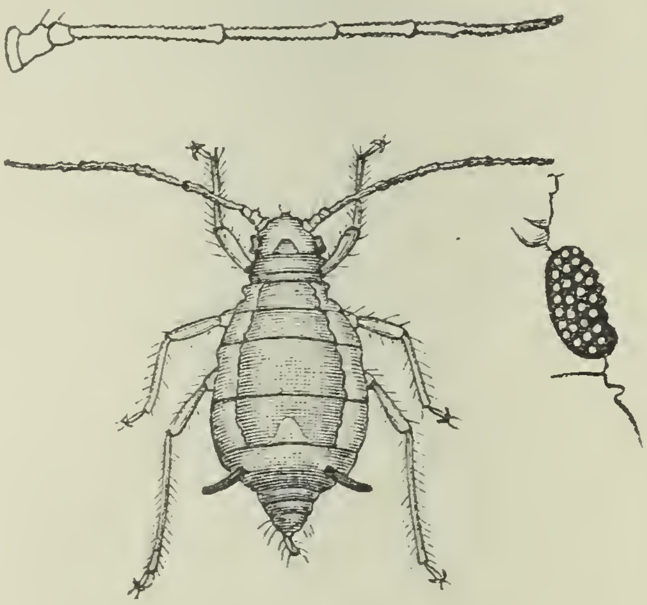


Fig. 14.



Siphonophora lactucæ. Linn?

There is much confusion in reference to the species of plant-lice inhabiting the common garden Lettuce; and it is at present, perhaps, impossible to identify the species named by Linnæus. Kaltenbach, Koch, Walker, Passerini and Buckton differ so greatly that not more than two out of the five authors agree on any one species. As the only specimens I have discovered were wingless, I am unable to determine amid this confusion, to which it belongs, and will therefore give briefly the descriptions by these authors so far as I have them at hand.

Koch's figure and description shows his species as follows: Size slightly above medium.

Winged-female.—The head, antennæ, a large dorsal spot on the latter part of the abdomen, and the honey-tubes black; eyes, thorax and front and sides of the abdomen a bright reddish-brown; legs yellow, with the tarsi and tips of the femora and tibiæ dark; tail pale yellow. Antennæ extending slightly beyond the tip of the abdomen; honey-tubes rather long; tail short and slender.

Wingless-female.—Somewhat larger. Antennæ and eyes black; head, thorax and abdomen bright reddish-brown; on the disk of the abdomen there is a large black spot with the central and larger portion of it pruinose or gray, and its lateral margins fringed by black; honey-tubes very long, slender and black; tail rather long and yellow; legs as in the winged female; the abdomen is slightly hairy, especially at the sides.

Kaltenbach states that this is his *Siphonophora sonchi* which he makes identical with *A. sonchi.* Linn.

Walker makes his species identical with the *A. lactucæ* of Linnæus and *A. ribis-nigri* of Mosely, and describes it as follows:

"*Winged-female.*—Grass green; head and chest black above and below; fore border and hind border of the fore chest (prothorax) green; a row of black spots on each side of the abdomen; feelers black, a little longer than the body; mouth (beak) pale yellow; with a black tip; nectaries black, as long as one-fourth of the body; legs pale yellow, rather long; feet and tips of thighs and shanks black; wings colorless, much longer than the body; wing-ribs and rib-veins pale yellow; brand (stigma) pale buff; branch veins brown, their tips slightly clouded."

Another variety is described by him as yellowish green, varied with pale red. Another as small and gray, with black on the thorax; honey-tubes yellow. A variety of the wingless female as small, oval, smooth, dull black or red, dark green toward the tip of the abdomen.

Passerini describes his *S. lactucæ* as new or at least distinct from any previously described under this name, marking with doubt the *Aphis lactucæ* of Schrank as synonymous.

"*Wingless-female.*—Green, oblong-ovate, convex; abdomen manifestly annulate with white-powdered incisures; honey-tubes greenish-yellow, fuscous at the tips; tail greenish, ensiform, and half the length of the honey-tubes.

"*Winged-female.*—Pale green, when young somewhat purplish, the dorsum transversely rugose; antennæ fuscous, first and second joints greenish white; wings hyaline, veins fuscous, subcostal vein and stigma dull greenish.

"*Pupa* and wingless individuals similar, wing-cases powdered with white.

"Differs from *S. malvæ* in the powdered marks on the abdomen, and in the longer tail.

"Found on the bracts, peduncles and flowers of *Lactucæ sativa* and *L. virosæ*, in Autumn.

"Walker, under his *A. lactucæ* seems to confuse this species with *Rhopalosiphum lactucæ*. Kalt."

Buckton adopts Kaltenbach's species as the true one, considers it as synonymous with Passerini's, and describes it as follows:

"*Wingless-female.*—Length .075 inches. Bright green. Some specimens more or less clouded with pink. Long oval. Head and thorax rather broad; distinctly separated from each other. Antennæ green, with paler basal joints. Vertex pointed and tufted. Abdomen domed, wrinkled and shining, with seven black dots within the edge of the connexivum. Cornicles thin, green, black at the tips. Tail long and yellow. Legs green, with black femora joints. Tibiæ points and tarsi black. The posterior rings are pilose. Kaltenbach and Walker state that the cornicles are thicker in their midst.

"The *Pupa* varies much in color, such as green, brown or pink. The *larva* much ringed and shining. Wing-cases green with black tips. The carinæ of the abdomen green and corrugated. Legs shorter than in the larva or imago. The pink varieties often have a green dorsal band and faint lateral stripes.

"*Winged-female.*—Expanse of wings .29 inch, length of body .09 inch. Head, prothorax and thorax shining black or dark brown. Abdomen green, with six or seven transverse dark bands, the middle band being the broadest. Four lateral spots on each edge; cornicles green with black tips. Antennæ long and thin. Legs pale yellow ochre, with black femora and tibiæ points. Wings with yellowish insertions and grayish stigma; other veins brown.

"This species feeds on many plants, particularly *Lactuca oleracea*, *Lactuca scariola* (garden lettuce) *Sonchers*, *Crepis* and other plants. It may also be found on the leaves of *Ribes grossularia* and *Ribes nigrum*. The branching of the veins is somewhat variable, and the length of the antennæ also differs in some individuals. The insect is commonly met with throughout the summer. It does not answer the description given by Koch of his *S lactneæ*, which certainly must be a different species."

The following description was taken from specimens found on common garden lettuce at Carbondale, Illinois, in 1878:

Wingless female.—Antennæ long and slender, extending back quite to and even beyond the tip of the abdomen; body of a rather long ovate form, rather narrow in front, thorax not much broader than the head. Legs very long; honey-tubes very long and slender, in some specimens distinctly though not strongly enlarged in the middle, extending beyond the tip of the abdomen, equal in length to one-fourth the length of the body; tail very prominent, slender and elongate conical, about half the length of the honey-tubes; beak rather short, reaching only to the insertion of the middle legs. The hinder portion and sides of the abdomen of some individuals are more or less roughened, and sparsely covered with little tufts of hair.

Color.—Body rather pale pea-green, many specimens showing from one to three deeper green longitudinal stripes on the abdomen; head pale; legs, antennæ, honey-tubes and tail transparent white; tarsi, and the antennal sutures in some specimens, dark.

Length of body about one-tenth of an inch.

An imperfect winged specimen found among these, whether the same species or not, I am unable to say, had the body dull black, smaller in size than the wingless; wings and other characters showing it to belong to this genus. Obtained in May.

It is more than probable that this and several other species found on garden vegetables will ultimately be found to be but varieties of one or two distinct species, the varietal characters probably being caused by the difference in plants and the changes produced by cultivation.

SIPHONOPHORA POLYGONI. Walk. The Knot-weed Aphis.

A plant-louse found during the early part of summer on the common knot-weed (*Polygonum persicariae*). As this species of knot-weed is common in England as well as here, our species is therefore in all probability identical with the English species. I searched carefully during the past summer for specimens but was unable to find any, and am not aware that the species has been observed in Illinois, although it has been found in the United States.

The following brief description is from English authors:

Winged viviparous female.—Yellowish or greenish; head and thorax unusually broad; antennæ longer than the body; honey-tubes long, passing the tip of the abdomen; legs with short stiff hairs on them; tail short. Head, prothorax and thoracic lobes brown; eyes red; ocelli distinct; abdomen marked with broken dark bands; honey-tubes black; tail yellow; legs yellow except the tips of the femora and tibiae which are dusky.

Length of body .07 inch; to tip of wings .15 inch.

SIPHONOPHORA? SALCICOLA. Thos. Aphis found on the Willow.

Found on the Willow at Peoria, Illinois, in the latter part of June, by Miss Emma Smith.

I have only seen specimens of this species in glycerine, and hence am unable to give a full description, or even to determine positively in reference to its generic characters.

Winged individual.—Antennæ seven-jointed and of the usual form in this genus; apparently on tubercles, but of this I could not be positively certain; all the joints transversely wrinkled. Beak of medium length. Tail distinct, curved upward, expanded in the middle and about half the length of the honey-tubes. Honey-tubes long, reaching beyond the tip of the abdomen, cylindrical and slightly enlarged at the base.

Wings of the form and neuration usual in this genus; the second fork of the third discoidal vein is very near the tip, the distance to the tip being not more than one-sixth of the distance to the junction of the first fork with the third vein; third vein obsolete at the immediate base; the subcostal vein runs very nearly parallel with the costal to the stigma and is transparent yellow in the specimens; stigma elongate, narrow and acutely pointed at the apex, yellowish. The specimens are so shrunken that it is impossible to ascertain the size, but it appears to be rather above medium.

The uncertainty in reference to the antennal tubercles, and the character of the plant on which this species is found, cause me to seriously doubt its belonging to this genus, the species of which seldom attack trees, and the shrubs on which they are found appear to be confined mostly to the Rosacea.

SIPHONOHORA VERBENÆ. Thos. The Verbena Aphis.

Found at Carbondale, Illinois, November 9th, on the leaves of Verbena.

Wingless female.—Of a bright pea-green color throughout, some specimens yellowish-green, with two or three deeper green longitudinal stripes on the abdomen. Eyes black. Antennæ about as long as the body, pale and colorless except at the tips where they are dusky. Honey-tubes reaching to or slightly beyond the tip of the abdomen, cylindrical, pale. Tail rather short, whitish. Beak extends rather beyond the middle legs. Body regularly ovate, somewhat elongate; medium size.

It is possible this is not fully grown.

SIPHONOPHORA RUBI. Kalt.

A few specimens of this species were found on the blackberrry during the summer; no winged specimens were obtained, but the characteristics were sufficiently marked to determine the species satisfactorily. As my material is not sufficient to give complete specific details I copy Buckton's description in full:

"*Wingless female*—length of body .13 inch; of antennæ .14 inch.

"Large, shining green, slightly pilose. Long oval. Head narrow. Antennæ and legs long and green. The articulations of the former are slightly marked with black. Eyes brownish red. Cornicles long, curved, and slightly thickened at their bases, then constricted, inflated at their midst, and finally expanded at their mouths. Cauda large and hairy. Tarsi black. Numerous during the month of May and June, clustered under the leaves of the bramble, *Rubus fruticosus*, and the wild raspberry, *Rubus idaeus*. Later in the year, about the end of July, they are common on the broom, *Sarothamnus scoparius*. Often they may be seen ranged with much regularity on each side of the sutures of the green pods, all their heads being turned in one direction. Walker describes the nectaries as tipped with black.

"*Winged female*—length of body .15 inch. Expanse of wings .42 inch. Antennæ longer than the body. Cornicles nearly one-third the length of the body. Very large. Wholly green, but rather redder on the thorax. Head with conspicuous red ocelli. Antennæ nearly half as long again as the body. Rest of the insect like the larva. Wings iridescent, with yellowish insertions, yellow cubitus and stigma. The whole insect is slightly pilose.

"*Winged male*—length of body .10 inch. Expanse of wings .38. Antennæ longer than the body. Cornicles one-fifth as long as the body.

"Green. Head very broad and black. Ocelli distinctly marked. Antennæ very long. Back, thorax and prothorax green, with black linear thoracic lobes and small scutellum.

"The abdomen very small, not equal to the length of the head and thorax together. Four or five transverse dark green dashes on the dorsum. Cornicles as in the winged female. Legs disproportionably long. Cauda small. Wings remarkably large. Stigma gray. From the under side, the valves which support the male organ can be easily seen. Some males are redder than the above. Occasionally the wings want the second cubital fork. Also the clavate characters of the nectaries is more marked in some specimens than in others.

"The males are not uncommon on the raspberry during the month of November."

SIPHONOPHORA PISI. Kalt. (The Green Dolphin).

Syn. *Aphis ulmariae.* Schr.
onobrychis. Fonscol.
pisi. Kalt.
lathyri. Walk.
Siphonophora pisi. Koch.
ulmariae. Pass.

This species, which is called by the common name "Green Dolphin" in England, sometimes appears in large numbers on the field pea, infesting the young shoots and leaves of the vine, and, according to my observations, even the young pod. Although found every year, it does not often appear in sufficient numbers to seriously injure the plants. It is also found frequently on several other plants as the meadow sweet (*Spirœa ulmaria*), sweet pea (*Lathyrus odoratus*), shepherd's purse (*Capsella bursa-pastoris*), the stinging nettle (*Urtica dioica*), etc. Although the past season was quite a favorable one for the increase of Aphides, I found but few specimens of this species, and these mostly sporadic. The descriptions given of the specimens found in Europe correspond so exactly with the characters of those found in this country, that they might be adopted without a single variation, but the description found below is from specimens found in Illinois.

Winged female.—Length of body about .10 inch, to the tips of the wings about .20 inch. Antennæ very long, extending to the tips of the honey-tubes, slender. Body rather elongate, sub-fusiform, acuminate behind; legs long and slender, and wings rather more than usually long. In the fore-wings the stigma is elongate and narrow, the apex being elongate pointed, the inner angle being so obtuse as to be almost obliterated; the fourth vein slightly curved except in the middle, where it is somewhat sharply curved. Head usually dull yellowish, or greenish yellow. Thorax pale brown, olive yellow or ocher yellow. Eyes black or dark brown; antennæ black or dusky, except the basal joints, which are whitish or pale green. Abdomen convex, smooth, sea-green. Honey-tubes varying from green to blackish, very long, extending beyond the tip of the tail, their length fully equal to one-third the length of the body (exclusive of the tail), usually described and figured as cylindrical or slightly enlarged toward the base; while this is the case with the apterous individuals, in all the winged specimens I have examined they are slightly enlarged in the middle portion. Tail distinct, elongate-conical, slender, curved upward and usually yellowish or pale green, less than half the length of the honey-tubes. Wings pellucid, costal and sub-costal veins pale at the base, yellowish or darker towards the extremity; discoidal veins dark and distinct; stigma pale brown or ocher color.

Wingless female.—Large, length of body .11 inches. Shining, bright green of various shades, "sometimes mealy and dull, showing the darker green tint below in transverse bands." Elongate oval, acuminate behind. Eyes black; front of the head and two first joints of the antennæ somewhat paler than the rest of the body; tips of the femora and tarsi, and tips of the honey-tubes, dusky. Tail about half as long as the honey-tubes, rather slender, elongate conical. Antennæ about as long as the body. Beak rather short.

Passerini says *Siphonophora gei* is also a synonym of this species.

Taken in latter part of May at Carbondale, Illinois.

SIPHONOPHORA GERARDIÆ. n. sp.

This little species is given with some hesitation, as but few specimens were observed, but as these were partly wingless, and in various stages of growth, and were observed on the same plant at two points some distance apart, I feel warranted in describing it as new and giving it a name in accordance with what appears to be its sustaining plant.

Winged individuals.—Antennæ on distinct tubercles; the first joint about twice as long as the second; third and seventh about equal in length; fourth and fifth about equal, and each about two-thirds the length of the third; sixth about half as long as the third; whole length about equal to the length of the body.

Body entirely blackish with a purplish tinge; posterior legs black; the other two pairs with the femora and tibiæ a transparent yellowish white. Honey-tubes black, slender and cylindrical, about one-fourth the length of the body and reaching considerably beyond the tip of the abdomen. The first fork of the third vein bends strongly forward toward the apex so as to bring it quite near to the fourth vein; second fork nearer the apex of the wing than to the third vein; wings honey-yellow at the base.

Pupa.—Wing-cases dark green; first two and last two joints of the antennæ black; other markings as in the winged specimens.

Wingless individuals.—The body is dark with a greenish tinge, and has a dark or black median dorsal line. Tail conical, about one-half the length of the honey-tubes, black.

Found on the little stems of *Gerardia tenuifolia*, at Carbondale, Illinois, latter part of September. Size small. Length to tip of wings .12 inch.

SIPHONOPHORA HEUCHERÆ. n. sp.

In the collection received from Prof. Bundy, and, with the exception of the color as given in his note, described from alchoholic specimens.

Winged individual.—The front wings have the second fork of the third vein much nearer the apex of the wing than it is to the third vein; fourth vein regularly curved, and in some of the specimens it is forked near the tip; the costal vein curves outward very distinctly near the base, and is partially followed in this by the sub-costal vein. Honey-tubes long, slender, and cylindrical, reaching to or beyond the tip of the tail; tail distinct, quite prominent, slender, sub-cylindrical, scarcely conical, about half the length of the honey-tubes. The abdomen is short, broad, and very obtusely rounded at the tip. Body slightly hairy, and some of the hairs apparently capitate. Antennæ quite robust and extending to or beyond the tip of the abdomen, seventh joint as long or longer than the third; sixth very short, about one-third the length of the fifth; fourth about two-thirds the length of the third; tubercles distinct.

Wings transparent, veins quite distinct, brown or fuscous; stigma pale brown.

Length of the body .07 to .08 inch; to tip of the wings .13 to .14 inch.

Pupa.—Honey-tubes not reaching the tip of the abdomen.

Wingless.—Ocelli very distinct, with a little tubercle in the front of each ocellus; honey-tubes not reaching to the tip of the abdomen.

Prof. Bundy furnishes the following note in reference to this species:

"On *Heuchera hispida*. June, Sauk City, Wisconsin. *Winged female.*—Abdomen smoky green, darker on the dorsal aspectof the thorax and head, this part being almost or quite black. At first green throughout, deep sea green on the abdomen, paler elsewhere; head with a tinge of yellow; wings smoky iridescent; legs pale, darker at the joints, lightest toward the coxæ, reddish on the tibiæ. Pronotum in old individuals dark brown or black, bordered with green. Young female with pale wings, pale toward the base and tinged with yellow."

I think it quite probable that what Prof. Bundy calls the "young female" is the winged male.

The species appears so be quite distinct; and so far as I can ascertain is the first found on this genus of plants, usually designated by the common name "Alum-root."

SIPHONOPHORA CUCURBITÆ. n. sp.

Found on the leaves of squash vines at Carbondale, Illinois, in May, and described by Miss Nettie Middleton.

Winged specimen.—Large and green. Antennæ very long, reaching to or beyond the tip of the tail; third joint a little longer than the fourth; fourth about the same length or very slightly longer than the fifth; sixth not more than one-fourth or one-third the length of the fifth; seventh longest. Wings transparent, veins slender; the first fork makes a very acute angle with the third vein; second fork rather nearer the third vein than the apex; fourth vein curves sharply and approaches somewhat closely, in its middle, to the first fork; stigma elongate and narrow. Honey-tubes long, slender, and cylindrical, extending beyond the tip of the abdomen, but not to the tip of the tail, about one-fifth the length of the body. Tail long, sub-conical, more than half the length of the honey-tubes (in the wingless specimens). The form of the body in both the winged and wingless specimens is elongate and fusiform, the latter being slightly broader than the former. Length of body .10 inch; to tip of the wings .18 inch, and some appear even to exceed this size. Body green; head paler, more or less yellowish; thorax pale brownish or fawn-colored, or tinged with this color; abdomen green with a darker green median line; first and second joints of the antennæ pale, third dark, seventh light, shades of light and dark more or less alternating; honey-tubes green at base, changing to fuscous at the tip; tail greenish; eyes brown; stigma pale.

Wingless specimen.—Green, with few markings. Body slightly broader than the winged specimens, and elongate ovate; the abdomen tapering posteriorly to the elongated tail, which is elongate conical, its length more than half and almost equal to that of the honey-tubes. The honey-tubes are long, somewhat robust, and cylindrical, they extend beyond the tip of the abdomen, although the posterior tapering segments are much drawn out, but not to the tip of the tail; in most of the specimens examined under a strong magnifying power they appeared slightly and minutely wrinkled transversely, or what may perhaps better describe the appearance, pustulate or scaly. The length of body is usually rather greater than that of the winged specimens.

In both, the antennæ and front of the head are hairy, and many of the hairs appear to be capitate.

This species is very closely related to *Siphonophora dirhoda*, and if it were not for the fact that the latter is not known to feed on cucurbitaceous plants, I would have at once decided that the specimens found by Miss Middleton belonged to that species.

There are other species of *Siphonophora* that infest cultivated plants in Europe, which so far have not been noticed on the same plants in this country, but as it is likely an examination will show that they are here, I will mention a few which are most likely to be found.

SIPHONOPHORA TANACETI. Linn. The Tansy Aphis.

This species feeds on the common Tansy *Tanacetum vulgare.*

Winged individuals of a clear brown color, with lighter shades; eyes red; legs black, hairy; honey-tubes passing the tip of the abdomen; tail distinct, yellow; wings large. Wingless individuals, with the neck, hind margin of the prothorax and broad margins of the abdomen, yellow.

Length .07 to .10 inch; to the tips of the wings .19 inch.

SIPHONOPHORA FRAGARIÆ. Koch. The Strawberry Aphis.

This species feeds on the strawberry plant, especially the underside of the leaves and the stalks of the unripe fruit. A species which I presume is identical with this has been occasionally observed on strawberry plants in this state, but so far I have been unable to procure specimens, and hence give a brief description from Koch's work.

Winged female.—General color brownish-yellow, or ocher; the head, antennæ, thorax and honey-tubes black; a row of black dots along each lateral margin of the abdomen, and two larger spots of the same color behind the honey-tubes; legs brownish-yellow; tail prominent and yellow. Honey-tubes very long, extending beyond the tip of the tail. The stigma of the front wings very narrow (as shown in his figure.)

Wingless female.—Pale dull green or rusty-yellow; the head brown or dusky; antennæ and honey-tubes black.

This is a rather large species, the body being from .10 to .12 inch.

In 1875, Professor Riley received from Mr. W. W. Hopkins, of Kansas City, specimens of a plant-louse which was injuring his strawberry plants. From a copy of his notes on these specimens, which he very kindly sent me, I learn that they differ from Koch's description in wanting the spots on the sides of the abdomen in the winged female; and in the head of the wingless female being yellow; yet he decides, without serious doubt, that they belong to Koch's species. He names this variety *immaculata.*

SIPHONOPHORA MENTHÆ. Buckton.

Wingless viviparous female.—Length of body .08 inch, of antennæ .10 inch, of honey-tubes .025 inch.

Long oval, narrow at the head, very broad at the middle of the abdomen. Lively green, transparent, and often permitting the eyes of the embryos within to appear as red specks. Abdomen usually exhibits delicate lines, as if they were sutures of horny plates. Antennæ very long, slightly olive at their tips. Frontal tubercles very large, and slightly gibbous, eyes red. Head, thorax and abdomen, consolidated, and without perceptible separation. Cornicles cylindrical, greenish, and black at the tips. Legs long, hirsute; genua, olive; tarsi, black; conda, green.

Winged viviparous female.—Expanse of wings .26 inch, length of body 0.06 inch, of antennæ .07 inch, of honey-tubes .015 inch.

Bright green. Antennæ dark olive; the two basal joints green. Eyes red. Thoracic lobes and scutetlum olive. Abdomen carinated, with four dark spots within the folds. Nectaries fine and black. Legs green; hardly so long as those of the larva. Tarsi black. The gibbous character of the basal antennæ joints less marked. Wings with pale brown cubitus and stigma.

Some specimens show disjointed tranverse bars on the abdomen. (From Buckton).

Found early in July on the garden mint (*mentha viridis*) and later on the common broom (*Sarothamnus scoparius*).

SIPHONOPHORA ABSINTHII. Linn.

Aphis Absinthii. Walk.
Siphonophora Absinthii. Pass.

Length of body .08 inch, of antennæ .075 inch, of honey-tubes .012 inch.

Long oval, shining, dark brown, pilose, with small tubercles. Slightly powdered with white. Frontal tubercles small. Eyes red. Legs and cornicles rather short, brown. Tail rather obtuse.

Numerous in August under the leaves of the wormwood, *Artemisia absinthium.* (From Buckton).

GENUS. PHORODON. Pass.

Beak moderately long, reaching the middle coxæ. Antennæ hardly longer than the body; the first joint bluntly toothed or gibbous at the internal margin; fourth and fifth joints nearly equal; third joint longest; the inner margins of the tubercles developed into a blunt tooth. Honey-tubes long, cylindrical and sometimes slightly clavate. Tail short. Legs short, or of but moderate length.

The chief characteristics are the toothed tubercle and the gibbous antennal joint. The genus is closely allied to *Siphonophora* on one side and *Aphis* (restricted) on the other; and has no substantial characteristics.

PHORODON HUMULI. Schrank. The Hop Aphis.

Our species is probably identical with the Hop Aphis, of Europe, as no appreciable differences between the characters of the two can be observed.

This is, perhaps, one of the most injurious of the family, in some instances almost entirely destroying the hop crop. As an indication of the immense loss which it sometimes occasions, we mention the fact that in England it occasioned, in a single year, a loss of over $400,000 on excise duty on hops; in other years since that time the loss has been even much greater.

On account of its injurious effect upon this important crop, I give a more extended description of its various stages, and a fuller account of its habits, than I have usually done with reference to the other species.

The *larvæ*, or young lice, are of a transparent yellowish white color, with black eyes, but as they increase in age and size, they change to green.

The *pupa*.—Green throughout, and slightly pilose, the head and thorax broad and squarish; on the top of the head are two red dots which mark the spots where the ocelli will appear. Even while in the larvæ state the interior prolongations of the antennal tubercles are very prominent, and the gibbous form of the first joint is very apparent. At the time they commence to enter the pupa state the abdomen assumes an oblong shape with the sides parallel; after the wing-cases appear the oval form begins to be assumed. Eyes red.

Wingless viviparous female.—It is small, oval in form, and pale green throughout; eyes red. Antennæ somewhat shorter than the body; legs of moderate length; honey-tubes long, extending beyond the tip of the body, cylindrical; tail very short and conical; the tubercles and first antennal joints as described. Slightly deeper green spots are sometimes seen on the back; but the usual green color prevails throughout all the parts.

Winged viviparous female.—General color pale green. Antennæ about as long as the body, greenish at base, apical portion dusky; eyes reddish; head, band on the prothorax, lobes of the thorax, one or two cross stripes on the abdomen, and a row of dots along each lateral margin of the abdomen dark brown or black, honey-tubes green; tail pale; legs green with dusky joints. The frontal tubercles and first joint of the antennæ less prolonged than in the pupa or wingless individuals. Length of the body about .07 of an inch; to the tips of the wings .15 inch.

Winged male.—Size small, body short and narrow; head very broad and prominent in front; abdomen not broader than the thorax. Color wholly green, except the lobes of the thorax, which are olive. Length of body .05 inch; to the tips of the wings .11 inch.

The *Aphis mahaleb* of Fonscolombe is but a variety of this species, and has the same injurious habits; it is described below.

According to Dr. Fitch, this species had not been known in this country to an injurious extent until 1862, when it suddenly made its appearance in excessive numbers; and, as a consequence, the hops were injured to such an extent that they were rendered valueless in many yards, and in the best were deficient to the extent of from fifteen to twenty-five per cent. According to this writer, the disease known to hop-growers as "honey dew" and "black blight" are caused by this Aphis. As the young lice attach themselves to the under side of the leaves, and as is the custom of the insects of this family, pump the juices so rapidly as to more than supply their wants, the overplus exudes from the honey-tubes and drops on the upper surface of the leaves below them, thus readily accounting for the presence of the honey-dew. This deposit of honey-dew, being subject to the action of the atmosphere and alternately moistened by the dews at night and dried by the sun during the day, is decomposed and changed from a transparent fluid to a black substance resembling soot, on which account the term "black blight" is applied to it.

It has been supposed by many observers that dry weather favors their increase, while wet weather retards it, and both Fitch and Harris favor this idea as applied generally to plant-lice. My own observations do not wholly agree with this opinion, as I find that dry seasons appear to favor the increase of some species while others appear to be more abundant during hot moist seasons. Heavy rains, as a matter of course, are unfavorable to all kinds, but there is a difference in the effect of moisture and of heat on different species. Dr. Fitch quotes a paper read by F. W. Dogget, Esq.: "Upon the Weather in connection with Aphis Blight and the growth of Hops," before the London Meteorological Society, in 1854, in which he says that "the years in which an excess of rain had fallen in or about the three months ending in September of the previous year—the three following months and the March following being both comparatively deficient in rain—were followed by a short crop of hops, arising from the Aphis blight; and on the contrary, when the quarter ending in September of the previous year had been dry, an average or large crop had been grown. And when the quarter ending in September had been wet, and the December quarter very wet, a like result had followed."

But following this comes this very important statement: "This however was found to be modified by the temperature. When the weather of the previous year has been such as to indicate a blight, there may be a partial recovery if the temperature succeeding should be hot—with few exceptions, all the small crops were grown in years in which the temperature of the three summer months was below the average, and the large crops were produced in those in which the temperature of like period was high." I think it is apparent from these facts that in this case these differences are owing chiefly to the condition of the leaves; if the season is hot and dry the leaves are less succulent, and unfavorable to an increase of the Aphides, but when the conditions are such as to render them succulent the insect will increase.

The operations of this species are very briefly and clearly described thus by an old author: "The progress and usual termination of the aphis blight may be thus described. The flies on their first arrival, immediately suck the underside of the upper small leaves of the vine (stem) and thus they deposit their young, upon the most succulent part of the plant. The multiplication of the lice is so rapid, that the leaves become so thickly covered as scarcely to allow a pin to be thrust between them. They quickly abstract the juices of the bine, so that the leaves assume a sickly brown hue, and curl up, and the bine itself ceases to grow and falls from the pole, the lice continuing till they perish for want of food; and thus, without the intervention of a favorable change, the crop is destroyed, and the grower may often consider himself fortunate if the plant recovers a due amount of vitality to produce a crop in the following year, for occasionally the hills are killed by the severity of the attack. This description of course applies to the most severe and unusual blights."

Although I give at the end of the list of this group of plant lice an account of the remedies for their destruction, it is proper to make the following statement here in reference to the remedies thought to be applicable to this species.

Kirby recommends rubbing the leaves between the fingers, but even with the cheap labor in England this was found to be wholly impracticable if ever attempted. Syringing, with this and other species, has been found ineffectual. Dr. Fitch thinks it is possible to contrive some method of confining tobacco smoke around the plants and thus destroy them. If this could be done, without too great expense—which is doubtful—it would be effectual.

Buckton, the latest English authority on aphides, remarks as follows in reference to remedies for this species: "It is believed, however, that hitherto all plans and schemes practically have failed, and that the farmer will find henceforth his best policy to consist in the study of the economy of the aphis under notice, and in a furtherance, as far as may be in his power of the increase of some of the natural foes which prey upon it."

PHORODON HUMULI var MAHALEB. Fonsc.

Aphis mahaleb. Koch.
Myzus mahaleb. Pass.

Wingless viviparous female.—Length of body .11 inch. Length of antennæ .07 inch, of honey tubes .03 inch.

Rather larger than *P. humuli;* abdomen also broader. Figure long oval. Head and thorax, taken together, equal to only one-fifth of the length of the body. Color yellowish-green, with three darker green stripes on the back. Head narrow. Frontal tubercles porrected, but less so than in *P. humuli.* First antennal joint gibbous. Eyes red. Legs and antennæ green.

Winged viviparous female.—Expanse of wings .28 inch. Length of body .075 inch; of antennæ .07 inch, of honey tubes .015 inch.

Bright green, shining. Head, lobes of the thorax, antennæ and legs, with the exception of the upper parts of the femora, black. Abdomen with several interrupted, dark, transverse bands, and three large spots on the carina. Two black spots under the insertions of the wings. First antennal joint gibbous.

Common in May and June on the sloe, and also on the garden plum, under the leaves of which it forms considerable companies, though not so large, perhaps, as those of *Aphis pruni.* (From Buckton.)

PHORODON SCROPHULARIÆ, n. sp.

This somewhat singular species was found by Miss Middleton, on *Scrophularia nodosa;* in the vicinity of Carbondale, Illinois, April 13, 1878.

Wingless individuals.—(The only ones seen).—Antennæ on distinct tubercles, seven-jointed, as long or longer than the body; third joint long, but not so long as the fourth and fifth united; the inner margin of the tubercle and first joint, each very distinctly extended and enlarged into a prominent rounded and blunt process, more distinctly so than any other American species with which I am acquainted. Honey-tubes extending beyond the abdomen and distinctly enlarged in the middle. Tail short and conical.

The very young are green or pale pink. Eyes dark brown or black. Those that appear to be full grown vary in color from a reddish-brown to a brownish black on the upper side, paler beneath. Legs pale throughout. Of medium size. In some individuals the honey-tubes do not appear distinctly enlarged in the middle.

I have considerable doubt as to the proper generic position of this species, as the inner margin of the tubercle and first joint are not toothed but tuberculiform. The form of the honey-tubes would place it in *Drepanosiphum.*

Note.—The plant on which this species was found was immature, it was supposed to be *S. nodosa*, but there is reason to doubt this, and the matter cannot be decided until next season.

GENUS MEGOURA. Buckton.

"Head broad; front flat; rostrum rather short. Antennæ much longer than the body; frontal tubercles large; remote at their bases; third joint longest; second joint twice the size (length) of the first; fourth joint longer than the fifth; seventh joint setaceous. Abdomen globose, convex; cornicles (honey-tubes) long, dilated in the middle, expanded at the ends, or trumpet-mouthed. Cauda (tail) markedly long and thick. Wings and legs as in *Siphonophora.*" Buckton.

Although some of the characters of the following species may vary slightly from Buckton's generic description, yet I am fully satisfied that it belongs to this genus, and that Buckton was clearly justified in forming the genus.

MEGOURA SOLANI. n. sp.

A very singular species of plant-louse found on the tomato.

Winged female.—Antennæ seven-jointed, a little longer than the body; first and second joints short; third and seventh longest, nearly equal; fourth a little shorter than the third; the fifth not quite as long s the fourth; sixth about half or less than half the length of the fifth; tubercles prominent. Honey-tubes extending beyond the tip of the abdomen; excessively enlarged in the middle, and expanding at the tips in trumpet shape. Tail of moderate length, about one-third as long as the the honey tubes, conical. Wings as usual in *Siphonophora*; fourth vein strongly and regularly curved; second fork about equally distant from apex and third vein; stigma elongate, slender and pointed. Size rather large.

General color greenish; tail greenish yellow at the base, darker at the tip; body greenish or pale greenish yellow; antennæ dusky. Another winged specimen, probably a male, varies considerably from the above description; the second fork of the third vein is very short and near the apex, and in some cases is absent in one wing and present in the other. Honey-tubes, with the enlargement less than the preceding, and carried nearer to the apex; apex with the expanded rim. Antennæ also differs slightly in the respective length of the joints. Head and abdomen olive green; thorax and eyes black; antennæ dusky; legs pale, dark at the knees and tarsi.

Pupa.—Elongate oblong in form; very pale green, with a dark green stripe along the middle of the back, with apparent whitish powder sprinkled sparsely over the body. Head whitish; base of the antennæ greenish-white, rest pale fuscous, dark at the tips of the joints and at the tip of the antennæ; eyes brown; femora greenish-white; tibiæ fuscous, tarsi darker. Honey-tubes long, slender, pale at base and dusky at the tips. Tail short, coincal, greenish.

Although quite a number of these insects were obtained, they were never found congregated at one point, but scattered singly over the leaves and stems of the tomato plant. Their feet were clogged with the viscous fluid which exudes from the plant, so as to give them the appearance of being club-footed.

The winged females were allowed to remain too long after capture before being described, hence the color had somewhat faded and is not given in detail on this account. My note on these faded specimens is as follows: "Legs pale; head dark; prothorax pale, with a fuscous streak; disk of the thorax black; base of the abdomen pale, with a large dusky spot on the dorsum; antennæ dusky. The colors have evidently faded."

Taken in May, at Carbondale, Illinois.

GENUS MYZUS. Pass.

Very similar to the genus *Aphis* in its restricted sense, but in some respects closely related to *Phorodon*.

Antennæ about equal in length to the body; the tubercles on which they are situated, in the males, have the inner margin prolonged; the inner margin of the first joint advanced or gibbous, but not toothed.

Honey-tubes rather long; tail about one-third the length of the honey-tubes.

There is really no necessity for this genus, and it ought to be suppressed.

Myzus cerasi. Fab. The cherry-tree Aphis.

This is another introduced species of this numerous family, and, like most of the European or Eastern insects which have been introduced into this country, appears to thrive equally well, if not better, than its congeners, as it is in some sections the most common and abundant species. Goreau describes the species found in France as averaging a little less than one-tenth (.08) of an inch in length; body black; antennæ black; with the middle portion yellowish; abdomen black; legs black, the tibiæ pale yellowish; wings pellucid. Found on the under side of the leaves of the cherry-tree, which they roll and crisp.

As seen in this country, the wingless female measures about five or six hundredths of an inch in length, the winged individuals measuring to the tips of the closed wings, rather over one-tenth of an inch. The winged female is of a shining black color, the abdomen is nearly twice as broad as the thorax, giving it an ovoid or egg-shape, with the smaller end in front, which is more clearly shown in the wingless individuals; antennæ black, about three-fourths the length of the body; the beak short, black or dusky; legs black except the basal half of the thighs and the basal portion of the tibiæ, which are pale or whitish; wings pellucid; the base, outer margin and rib-vein, white; remaining veins usually dusky; the second vein is about a third farther from the first at its tip than at its base. The honey-tubes long cylindrical and black; tail one-third the length of the honey-tubes. Sometimes the abdomen is clouded with yellowish green.

The wingless females agree very nearly with the above, so far as relates to the body. The antennæ are whitish, except the two basal joints and apical half; beak, whitish, with the tip only black; legs white; feet, tips of tibiæ and tips of thighs, black. The abdomen has an elevated lateral margin.

The young larvæ are at first dull white or pale yellow, but grow darker as they increase in age.

This infests the leaves of the cultivated or garden cherry-tree (*Cerasus vulgaris*), to the varieties of which it appears to be exclusively confined. They hatch out in the spring as soon as the leaves begin to unfold. There are a number of broods produced in the same manner, and similar in habits to the other species of the genus; although the summer broods appear to be exclusively females, among them we often find winged individuals. They often become very numerous, covering the under side of the leaves with their colonies, and sometimes piled one upon another. Dr. Fitch states that in 1855 the leaves of his cherry trees were literally covered with these lice; that at the time they were most abundant he made an estimate of the number on a single small tree, but ten feet high, and was astonished to find this to be at least twelve millions.

When very numerous, this species does not confine itself to the leaf alone, but extends its colonies to the stalk, and even to the tender twigs, and buds, and fruit stems, and occasionally to the green fruit. The tough, rigid texture of the cherry leaves prevents them from becoming wrinkled, like those of some other trees; but the margins curl, and there is a tendency to curl backwards. When they attack very numerously the twigs and young leaves, the extraction of the sap causes them to shrivel and die. This species is quite common in Illinois, and according to Walsh, has been observed on the plum; but this fact appears somewhat at variance with the fact that it will not develope on any species of the cherry except the one mentioned.

Since the previous sentence was written this species appeared here (1878) in great abundance, numbers covering the twigs and axils of the small limbs of both young cherry and plum trees; showing that Walsh was correct. I suggested a means of destroying those on the small trees, but before it was tried, copious rains, or some other cause, suddenly swept them away.

MYZUS PERSICÆ. Sulzer. The peach-tree Aphis.

This is also an imported species. It lives on the underside of the leaves of the peach-tree, causing them to thicken and curl, forming hollows beneath and corresponding crispy swellings above, and causing them ultimately to perish and drop off prematurely.

The winged female—Is very variable in color, some to the naked eye appearing quite black, whilst others are brown, olive brown or greenish black. The honey tubes slender and cylindrical; tail pointed and black. The third joint of the antennæ sometimes tuberculated. Beak reaches nearly to the insertion of the third pair of legs. Length of body .08 inch; to the tips of the wings .18 inch.

Wingless females.—Ovate, rusty red; head broad, and the antennal tubercles enlarged on the inner side. Antennæ legs and honey tubes greenish; honey-tubes long and cylindrical.

Winged male.—Bright yellow. Head, band on the front or prothorax and some transverse streaks on the back, brown. Eyes red; honey-tubes black; tail small and black.

It is common on the nectarine as well as the peach; and is found from May to October.

MYZUS RIBIS. Linn.

Aphis ribis? Linn. Fabr. Schr. Kalt. Walk.
Aphis ribicola? Kalt.
Rhopalosiphum ribis. Koch.
Siphonophora ribicola? Koch.
Myzus ribis. Pass. Buck.

This species varies very greatly, and it is possible that more than one species is included in the above synonymy, but from all the facts I am at present able to obtain I prefer to consider these differences as varietal rather than specific.

Buckton's description from English specimens found on the red currant (*Ribes rubrum*) and gooseberry (*Ribes grossularia*) is as follows:

Apterous viviparous female.—Length of body .085 inch; of antennæ .09 inch; of honey-tubes .015 inch. Long oval. Shining yellow or green, with darker green mottlings. Front flat, garnished with short bristles, as also are the sides. Antennæ long and very fine. Honey-tubes, pale green. Eyes bright red. Tail obtuse. Legs yellow or greenish.

Under a high magnifying power these bristles are capitate, a fact not in accordance with the experience of Passerini, as regards the Italian species.

Pupa.—Large, shining yellow or green. Two brown spots on the occiput. Abdomen convex and glistering.

Winged viviparous female.—Length of body .10 inch; antennæ .09 inch; honey-tubes .02 inch. Bright greenish-yellow. Head pale olive. Eyes red. The three ocelli obvious. Antennæ fixed on small tubercles. Prothorax with an indented olive band. Thoracic lobes brown. A stellate spot is seen on the post thorax, succeeded by six or seven irregular transverse bands on the abdomen of varying thickness (width); four or five spots on each lateral edge. Honey-tubes green or olive, cylindrical, or at least very slightly clavate. Legs green, with olive femoral points and tarsi. Wings broad, with yellow insertions, greenish sub-costa and veins. Stigma grey. This he says is found plentiful on the plants mentioned, from May to July.

The species which Koch describes as *Rhopalosiphum ribis* is found on the currant in May, congregated on the underside of the leaves and causing them to cup and blister as is the case in this country.

The *winged specimen* is bright yellow; the head brown; eyes black or dark brown; prothorax yellow; the disk of the thorax or thoracic lobes, black; abdomen bright yellow, with black points along each lateral margin, and three transverse black bands on the posterior portion. Honey-tubes slightly enlarged towards the tip; extending rather beyond the tip of the abdomen, yellow. Tail rather short, yellow. Body elongate oval. Antennæ dusky, rather longer than the body; third-joint pustulate on the sides, longer than the fourth, but not quite as long as the seventh; the basal joints scarcely presenting any enlargement on the inner margin. Legs pale, dusky at the joints and tarsi.

The *wingless specimen*, as figured, is pale yellow; eyes small and dark; some ochreous points along the lateral margins of the abdomen; legs and antennæ pale; honey-tubes cylindrical, reaching tip of the abdomen.

The *Aphis ribicola* of Katlenbach or *Siphonophora ribicola* of Koch, as figured and described by the latter, is as follows:

Winged specimen.—Body grass-green; antennæ, head, eyes, thoracic lobes, spots on the abdomen, and the tail, black. The abdomen has a row of black dots along each lateral margin, and some partial bands of the same color. The honey-tubes, extend rather beyond the tip of the abdomen, are cylindrical, black at base and pale or yellowish toward the tips. Tail rather short, scarcely half as long as the honey-tubes, black. Discoidal veins of the forewings nearly straight; stigma long, narrow, with scarcely any inner angle at the point where the fourth vein arises. Fourth or stigmatic vein, curving regularly in the form of the arc of a circle. Second fork of the third discoidal vein about equally distant from the apex and first fork. Wings are marked as reflecting a reddish color, and slightly smoky. Legs pale; joints and tarsi dusky.

Wingless specimen.—Pale pea-green; antennæ, head, honey-tubes and legs dull ochreous. Sides of the abdomen with darker green spots; transverse rows of white spots on the back or dorsal portion. Honey-tubes not extending beyond the tip of the abdomen, cylindrical. Tail prominent fully half as long as the honey-tubes; green.

Genus DREPANOSIPHUM, Koch.

This genus is characterized as follows, by Buckton :

Rostrum short ; penultimate joint long. Antennæ long and fixed on the frontal tubercles ; third joint longest ; fourth and fifth joints equal ; seventh setaceous, [and longer than any other except the third]. Honey-tubes large, curved and dilated in the middle. Legs moderately long. Cauda (tail) inconspicuous or none. Wings long and narrow. Cubital (third discoidal) vein twice forked. Stigmatic cell elongated towards the apex of the wing ; other veins parallel to each other or nearly so. The membrane slightly clouded toward the marginal ends of the veins.

It is stated by Walker and others that there are no apterous, viviparous females in this genus, or in other words that all the females develop into pupæ and thence into winged forms before they produce young. The habits of the genus are sporadic ; large companies are not formed, but they collect under the leaves in little groups rarely exceeding five.

I am not aware that any species of this genus has been positively detected in this country, but it is more than probable that future observations will bring one or more to light. I insert a description of *D. acerina*, Walk., as it is possible this is one of the species found on our maples. My *Siphonophora acerifolia*, which has been placed in that genus provisionally, agrees in several respects with the characters of *Drepanosiphum*, as for example the solitary habit, and I suspect also in the viviparous female being always winged.

Drepanosiphum acerina, Walk.

Aphis acerina, Walk.
Drepanosiphum aceris, Koch.

Wingless viviparous female.—Length of body .07 inch, of antennæ .10 inch, of honey-tubes .015 inch.

Bright orange with redder sides. Body deeply segmented and carinated. Head very broad. Eyes red. Front convex. Antennæ long and joints tipped with rich brown. Legs short and stout; femoral tips and tarsi brown. Body hirsute. The dorsum is very transparent, and shows the oil-globules within the abdomen. These often are disposed in regular rows. Rostrum short. The young specimens are lemon-yellow, with antennæ twice the length of their bodies, and with honey-tubes disproportionally large.

Winged viviparous female.—Length of body .08 inch. Expanse of wings .30 inch. Length of antennæ .19 inch, of honey-tubes .025 inch.

Somewhat linear. Head and thorax nearly as wide as the abdomen. Bright yellow. Eyes large and red. Antennæ very long, more than twice the length of the body. The joints tipped with brown. Two thoracic lobes and the scutellum rich sienna brown. Two broad cross-bars on the abdomen brown. Cornicles very stout. Legs yellow. Wings ample. Cubitus, stigma, and veins either green or pale brown. Tail inconspicuous. Rostrum short, not reaching to the second coxæ. The whole insect is hirsute. (Buckton.) Feeds on *Acer psendoplatanus.*

DREPANOSIPHUM? QUERCIFOLII, Walsh.

Syn. *Aphis quercifoliæ*, Walsh.

"*Larva*, pale greenish. Incisures of the antennæ dusky. Upper surface of the body, except the scutel, dusky. Honey-tubes long, robust, dusky at tip. Legs long, with the terminal three-fourths of the femora, the extreme tips of the tibiæ, and the tarsi obfuscated.

"*Imago* blackish; prothorax and anterior part of the thorax sometimes varied with greenish; scutellum pale greenish. Honey-tubes two-thirds as long as the femora. Legs very long; basal half of femora pale greenish. Wings hyaline; veins brown, third discoidal vein hyaline at its origin; stigma and sub-costal veins pale yellowish brown; extreme tip of the front wings slightly fumose. Length of the wings scarcely .2 inch." "The antennæ attain the extreme tips of the wings when the wings are expanded; and the stigma is four times as long as wide, and very acute at each end. On oak leaves."

Although it is impossible to state positively, from this description, the genus to which this species belongs, yet I think it almost certain that it should be placed in the genus to which I have assigned it. It is certainly not an Aphis, in the restricted sense, and the plant it infests would indicate that it is not a *Siphonophora.*

Genus RHOPALOSIPHUM. Koch.

This genus is evidently closely allied to *Aphis* and in a strictly natural arrangement should be placed in close proximity. Passerini, in his arrangement, places it between *Phorodon* and *Myzus*. That in some respects is also allied to the latter genus is clearly indicated by the antennæ of some of its species. Buckton places it between *Megoura* and *Siphocoryne*, *Aphis* following the latter, which is, undoubtly a better arrangement.

It may be characterized as follows:

Beak of medium length. Antennæ usually as short or shorter than the body, but occasionally exceeding it in length; third joint longer than the fourth; seventh setaceous and sometimes longer than the third. Wings, and size and form of the body, as in *Aphis*. Honey-tubes usually of medium length, seldom extending beyond the tip of the abdomen, dilated in the middle or near the end, and sometimes slightly curved. Tail present and distinct but small.

Species with long antennæ generally have rather long and robust honey-tubes, and are distinguished from *Drepanosiphum* chiefly by the size of the tail.

RHOPALOSIPHUM DIANTHI. Schr.

Found on carnation pink and German ivy by Miss Middleton, at Carbondale, Illinois, in March. Wingless only seen and these in balsam, but the characters together with the plants on which they were found are sufficient to determine the species. The characters so far as the color and the wings are concerned are taken from Koch.

Winged female.—Antennæ reaching to the tips of the honey-tubes, dark; head and thorax black; abdomen dark olive green, with dark transverse bands; honey-tubes extending slightly beyond the tip of the abdomen, slightly enlarged in the middle, dark or brown; tail small and concolorous with the abdomen.

Wingless female.—Antennæ as seen in the specimens examined, about as long as the body; the tubercle is distinctly enlarged and gibbous internally; third joint longest, this and remainder as usual in this genus. Body broadly ovate, the abdomen with the sides much rounded. Honey-tubes enlarged in the middle, same color as the abdomen; tail rather short and conical. Color as given by Koch, pale yellowish green with a darker green stripe in the middle and one on each side. Antennæ and legs pale.

RHOPALOSIPHUM TULIPÆ. n. sp.

Winged individuals.—Antennæ longer than the body, reaching to or beyond the tips of the honey-tubes when extended; the tubercle on which they stand, with a slight internal enlargement; the first joint very thick, with a slight protuberance on the inner side; third and seventh joints long; usual type. Honey-tubes rather long, extending beyond the tip of the abdomen and nearly or quite to the tip of the tail; distinctly enlarged in the middle portion, smaller at the base and at the tips, presenting the usual form in this genus. Tail about half the length of the honey-tubes, sub-conical and curved upwards. Wings of the usual form; second fork of the third vein rather nearer to the apex than to the third vein; thin, transparent, veins slender; the costal and sub-costal veins not parallel, the sub-costal rather robust, and slightly curving inwards about midway between the base and stigma. Stigma quite opaque, medium size, rather narrow, and acutely pointed at each end. Abdomen short, broad, and with broad margis. (The specimens are alcoholic, and this may haye something to do with the appearance.)

Front of the head and base of the antennæ black; prothorax pale; disc of the mesothorax dark brown or black; the hinder part of the abdomen with two or three transverse dark brown stripes; veins of the wings and stigma brown; honey-tubes pale brown.

Wingless specimens.—As compared with the winged, large and elongate; honey-tubes very long and slender, not enlarged in the middle; reaching to the tip of the tail; tail very long, equal to one-fourth the length of the body exclusive of the tail. Form of the body elongate oval. Front of the head appears to be deeply grooved, resembling very much a *Siphonophora* and so different from the winged individuals as to cause one to doubt the two belonging to the same species.

Length of body of winged .08 inch; wingless to tip of the abdomen .09, to tip of the tail .12 inch.

Dr. Bundy, from whom the specimens were obtained, furnishes the following note in reference to them:

On *Tulipa gesneriana*. *Female.*—Abdomen, below pale uniform pea-green; above darker sea-green; darker transverse lines on the posterior half; honey-tubes black; a row of black spots on the sides; head and thorax dark, blackish green, with a suggestion of orange; prothorax pale below; antennæ and eyes black; legs generally dark, paler on the basal half of the femora. Wings dusky, with a steel-blue reflection on the outer half; basal half with a coppery reflection; a long, dull stripe on the margin of the forewings.

The dull stripe on the forewings is doubtless the broad sub-costal vein.

The only Aphis hitherto described from the tulip, of which I can find any notice, is *A. tulipæ.* Fonscol. France. The description is found in *Ann. Soc. Ent. Fr. x.* 167, which is inaccessible to me at present. It is possible, therefore the two may be identical, if so my specific name will remain good, and I think the generic position correct, but the name of the original describer will have to be attached as author.

It approaches *Myzus* in some respects.

Rhopalosiphum berberidis? Kalt.

Syn. *Aphis berberidis.* Fitch.

I have considerable doubts of the identity of Dr. Fitch's species with Kaltenbach's, but concluded to consider them as one, although I have seen no specimens.

Dr. Fitch's short discription is as follows:

"Black; the breast and abdomen pale yellow, tip black. Larva and pupa pale, with a green or black stripe on each side of the back parallel with the outer margin. Length .10 inch. Found on the under side of the leaves of the barberry."

Kaltenbach's species, as given by Koch, is as follows:

Winged viviparous female.—Antennæ reaching about to the base of the honey-tubes. Honey-tubes, extending to the tip of the abdomen, and considerably swollen in the middle. Tail minute. General color pale buff or yellow; antennæ pale at base, remainder dusky; eyes black.

Wingless female.—Antennæ short not reaching to the middle of the body, pale dull yellow; eyes black; legs and honey-tubes dull yellow; body pale rusty red. Size about the same as that given by Dr. Fitch.

Genus HYALOPTERUS. Koch.

This genus is closely allied in some respects to *Aphis*, and in others to *Callipterus*.

The antennæ are situated on tubercles which brings it into the section now under consideration, but in a strictly natural arrangemenit should fall below *Aphis* and between that genus and *Callipterus*.

The characters were very briefly and imperfectly given by the author of the genus, but from the species he included we may judge them to be as follows:

Antennæ seven-jointed, situated on frontal tubercles; third joint usually longest; seventh sectaceous, sometimes as long as the third and sometimes scarcely longer than the sixth. Beak quite short. Wings as in *Aphis*, but thin and delicate as in *Callipterus*, though not marked or clouded as in that genus. Body, especially of the winged individual rather small and similar in form to that of the typical species of *Aphis*. Honey-tubes short, reduced almost to tubercles; cylindrical; tail slender, short and inconspicuous. Prevailing colors pale green and greenish yellow, the apterous individuals seldom with black markings.

The relative length of the honey-tubes and the tail appear to me scarcely to justify Passerini's character of this genus given in his Synopsis, and which I have followed with great doubt, as I have not had an opportunity of examining specimens.

The following species, which belong to this genus will probably be found in this country:

HYALOPTERUS PRUNI. Fabr.

Syn. *Aphis pruni.* Fabr.

This species is distinct from the *Aphis pruni* of Koch which is elsewhere described. I can only add here that the winged individuals are rather small, the head and thorax dusky or black; abdomen very pale green, antennæ and legs pale. Apterous individuals green, sides purplish or primrose; honey-tubes short not reaching half way to the tip of the abdomen, black; legs and antennæ pale or cinereous. Honey-tubes in the winged individuals little more than tubercles. Antennæ not longer than the body.

HYALOPTERUS AQUILEGÆ. Koch.

Very similar to the preceding except that the general color is more of a greenish yellow. Will probably be found here on our *Aquilegiæ*.

SECTION APHIDINI.

This section agrees with the preceding in the following characters: The front wings have three discoidal veins, the third being twice forked; the hind wings are furnished with two oblique veins. The antennæ are seven-jointed, the third usually the longest, and the seventh setaceous and generally next in length to the third. The species differ from those of the previous section as follows: The antennæ, instead of being supported on tubercles, are inserted directly on the front of the head; they are generally shorter, seldom exceeding the body in length, and often, especially in the apterous individuals, being considerably shorter, extending but little beyond the middle of the abdomen. The size is also usually less, and the legs shorter. The honey-tubes are shorter, seldom reaching to the tip of the abdomen, in many cases tuberculiform, and sometimes obsolete. The tail is usually small and inconspicuous and occasionally wanting.

From the following sub-family it differs, in having third discoidal vein of the front wings always twice forked. It differs from *Lachnini*, in having the antennæ always seven-jointed, and the seventh joint longer than the sixth, at least it is never shorter.

The habits of the species are similar to those of *Siphonophorini*. They usually reside on the leaves, twigs or slender stems of plants, but affect woody plants, such as trees and shrubs, as well as the more succulent.

In this group, as in the preceding, all the species (possibly there may be one or two exceptions) acquire wings at some time, and the rare exceptions are those whose history is but imperfectly known, and which doubtless develop winged individuals at some time.

It is in this group that I think it most likely the dimorphism, of which I speak in the introductory portion of this paper, probably occurs to the greatest extent in this sub-family.

Genus SIPHOCORYNE. Pass.

This genus appears to differ from *Rhopalosiphum* only in the fact that the antennæ are not situated on tubercles as they are in that genus.

I give here the characters of one species as I find them in the works of European entomologists. I select a species which will probably be found here as it is found on the cultivated parsnip.

SIPPOCORYNE PASTINACÆ. Linn. (The Parsnip plant-louse).

Syn. *Aphis capreæ.* Fabr.
Siphocoryne capreæ. Pass.
Aphis pastinacæ. Linn.
Rhopalosiphum pastinacæ. Koch.

I have not detected this species, but there can be but little doubt of its existence in this country on the cultivated plants on which it is found.

The color is a delicate greenish yellow.

Winged viviparous female.—Antennæ about as long as the body; third joint longest. Honey-tubes rather large, and very distinctly enlarged in the middle portion near the tips; extending beyond the tip of the abdomen. Tail distinct but small and not more than one-third or one-fourth the length of the honey-tubes. Head, antennæ and thoracic lobes dark brown or black; remainder of the body, the legs and honey-tubes pale pea-green or greenish-yellow. About or slightly above medium size.

Wingless female.—Pale green or yellowish throughout; a rather broad submarginal greenish stripe along each side.

Koch and Passerini consider *capreæ* as distinct.

The chief difference appears to be in the color, which is more uniformly green. The honey-tubes are also a trifle shorter, and the enlargement is thrown nearer to the tip. There may be some difference in the joints of the antennæ.

Infests the undersides of the leaves, and the tender stems of the common parsnip (*Pastinacea sativa*).

Genus APHIS. Linn.

This genus in its restricted sense includes only those species which have the antennæ of moderate length, usually shorter than the body and not placed on tubercles; similar in respective length of the joints, to *Siphonophora*, third and seventh longer than the others. The honey-tubes cylindrical, of moderate length, seldom reaching the tip of the abdomen, and always (or at least with few exceptions) longer than they are thick; body not hairy; legs of moderate length. Wings of the usual form; front wings with three discoidal veins, the third twice forked; hind wings with two discoidal veins. The beak of moderate length. Usually found on leaves.

There are some species included in this genus of which I have seen no specimens, it is possible therefore that a few may be wrong—but I think there very few such cases. In each case where there is doubt mention will be made of the fact.

Aphis mali. Fabr. The Apple-tree Aphis.

This, as its name indicates, is the common plant-louse, which is so frequently met with on the tender twigs and leaves of the apple-tree. It is more than probable that two or three different species are often counfounded under this common name; but practically this is of but little importance as the habits of the closely allied species are generally very similar, and the remedies to be used against them the same; still it is well for the horticulturist to be able, if possible, to identify the different species which injure his trees.

Fig. 15.

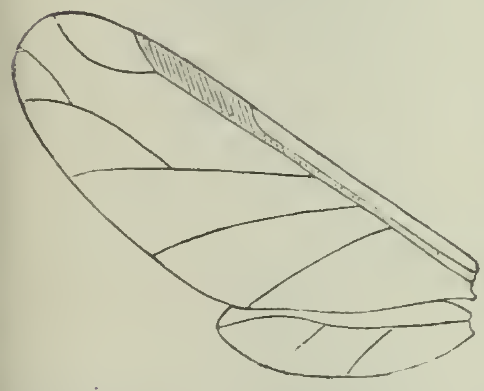
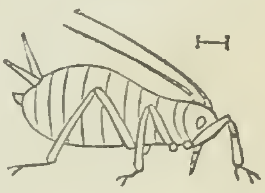


Fig. 16.



It is often quite difficult to determine whether the lice upon American plants are the same as the European species which occur on the same plants, as the descriptions by the early authors are very brief, and drawn up without proper examination and care; but a comparison of the Apple-louse of America with that of Europe, shows that they are identical, thereby making it evident that it has been imported into this country. But a change of locality has produced a slight change in the color, which for a time cast some doubt over this question. The following somewhat full description of this species will enable the reader to identify it with sufficient certainty.

The wingless females of the summer brood are somewhat less than one-tenth of an inch long, of a pale greenish color, with the head usually more yellow than the body. Stripes of a deeper green are usually present on the back: sometimes there is but a single middle stripe, with partial transverse ones at the joints of the segments. Eyes, black; beak, antennæ and legs, whitish with dusky tips; honey tubes as long as from their base to the tips of the abdomen, dull whitish, with black tips.

The winged males and females measure about one-eight of an inch to the tip of the closed wings; head and thorax black, the neck usually green, abdomen a bright grass green, with a row of black dots each side, one dot on each segment; on the under side of the abdomen, at the tip, are two square brown dots, and above, near the tip, often two or three dark transverse stripes. Antennæ black, scarcely as long as the body; the two basal joints short and thick, almost as broad as long; third joint the longest of all, the sixth only about half as long as

---

NOTE.—See No. II, figure 14. § The head and antennæ.

the fifth or seventh. Legs pale dull yellowish or whitish; feet, tips of the shanks, and of the thighs, dusky, the hind thighs blackish, except near the base. Wings transparent, but not perfectly pellucid; the stigma dull white.

Dr. Fitch mentions the following variations in color:

Antennæ, brownish yellow; neck not green, thorax dull green; abdomen, yellowish; abdomen without black dots.

The pupæ examined the past season from the extreme northwest part of the State presented the following characteristics:

General color pale transparent green, with three more or less distinct darker green lines along the back; the underside uniform bright apple green. Antennæ whitish except at the tips, about two-fifths the length of the body; honey tubes pale at the base, dusky at the tips, cylindrical, reaching nearly to the tip of the abdomen. Length about .08 of an inch. The very young are of a transparent whitish color throughout.

The thorax of the winged individuals sometimes has only the lobes black.

APHIS MALIFOLIÆ, Fitch. Apple-leaf Aphis.

This species, which was first described by Dr. Fitch, in 1856, has very probably, been often mistaken for the preceding on account of its similarity in habits. In fact, Walker, in the appendix to his catalogue, gives this name as a mere synonym of the former. It is possible, it is but a variety of the former; but I here follow Dr. Fitch, and give it as a distinct species.

It is larger than the *A. mali*, measuring rather over one-seventh of an inch to the tips of the closed wings; of a shining black color throughout; the legs are also entirely black, an occasional specimen being found in which these are pale brownish at the base. The wings differ very distinctly from those of the preceding species. They are more slender, and the fourth vein (of the front wings,) is relatively shorter and more strongly curved throughout its entire length. In consequence of this curvature, it is nearer the second fork at its base than at its tip. The third vein is but slightly aborative at its base. In the former species, the first fork branches from the third vein beyond its middle; in this species, it is given off much nearer the base, at about one-third the distance from the base to the tip; in the former species, the second branch or fork is much less than half as long as the first; in this species, it is usually half as long.

Dr. Fitch, from whose report the above description is chiefly taken, states that he gathered this species from the leaves of the apple trees in Mercer county, Illinois; two-thirds of all the specimens he gathered at the time belonging to this species.

I have noticed the same species in the southern portion of the State, and am inclined to think a close and careful examination of the Aphides infesting the leaves and twigs of our apple trees would possibly reveal the fact that this species is as common and as numerous as the *A. mali*, or, as Dr. Fitch believes, more numerous.

The name given implies that it is confined to the leaf, but this, I think, is a mistake; that this is the habit of the species, I think quite probable, and corresponds with my observations, of which, unfortunately, I have no notes, but I certainly have noticed the winged specimens, and if I recollect rightly, apterous individuals also, on the tender twigs.

Aphis pruni, Koch. The Plum-tree Aphis.

A. prunifoliæ, Fitch. The Plum-leaf Aphis.

I am satisfied that our species, which Dr. Fitch has named *A. prunifoliæ* is the *A. pruni* of Koch, but not the *A. pruni* Fabricius, as Dr. Fitch rightly supposed, nor the *A. pruni* of Scopoli, which is probably identical with *A. humuli* of Schranck.

This is much like the apple-leaf plant-louse both in appearance and habits, except that it selects the plum-tree as its food plant instead of the apple-tree. It is found on the underside of the leaves of our native and cultivated plums, wrinkling and destroying them. What is said in reference to the history of the apple plant louse will apply as a general rule, to this species, which does not appear to abound to the same extent as some of the species already named.

This species appears to be quite variable, but the following taken chiefly from the original description by the author of the species, will probably enable the reader to identify it.

The winged specimens measure about one-seventh of an inch to the tip of the wings; the body is of a shining black color, except the abdomen, which is pale green with a black dot on each side of the two or three anterior segments; a large dusky spot rather behind the middle; tip of the abdomen acuminate; honey-tubes cylindrical, reaching to the tip of the abdomen. The legs are pale, dull yellowish; antennæ black, except at the base, where they are pale. Wings pellucid; veins dusky, except the rib-vein. The venation does not appear to be as uniform as is usually the case in this genus.

The larvæ are more or less of a greenish white color, varying according to age. The wingless specimens are broadly oval in form; the average length about one-sixteenth of an inch.

Winged individual.—Antennæ about as long as the body dusky or black; head and thorax black, a greenish ring usually around the neck, and sometimes slightly powdered or pruinose; abdomen green with black dots on the lateral margins and usually a large black spot on the central portion reaching back to the honey-tubes, also two or three transverse black lines behind the honey-tubes; honey-tubes of moderate length reaching nearly to the tip of the abdomen, black; legs pale, dark at or near the joints.

Wingless female.—Antennæ scarcely as long as the body, basal joints dark, rest dull yellowish; head black; thorax and abdomen green, the former with two transverse dark lines, the latter with black marginal dots and a large black space on the central part; honey-tubes yellowish. Some specimens have the head greenish yellow and are without the large black spot on the abdomen. This sex has the body very broadly ovate.

This species appeared early in the season on one of my plum trees but soon disappeared; they were almost entirely black, this color prevailing to a larger extent than given by Koch.

Aphis rumicis, Linn. The bean aphis.

This is said to be one of the most injurious species of the entire group, not confining its attacks to a single plant, but spreading its colonies over a variety of species, on which account it has received a number of different specific names, which Mr. Walker has enumerated as follows: *A. rumicis*, Linn.; *A craccæ*, Linn.; *A. atriplicis*, Linn.; *A. fabæ*, Scop.; *A. genistæ*, Scop.; *A. acetosa*, Linn.; *A. aparines*, Fabr.; *A. euonymi*, Fabr.; *A. papaveris*, Fabr.; *A. hortensis*, Fabr.; *A. vicæ*, Fabr.; *A. chenopodii*, Schrank; *A. thlaspeas*, Schrank; *A. galliscabri*, Schon.; *A. armata*, Hans.; *A. laburni*, Kalt.; *A. dahliæ*, Mas.*

These names indicate the different plants on which it has been observed—as the dock (*Rumex*), the tufted vetch (*vicia cracca*), the garden orache (*Atriplex*), the bean (*Faba*), the dyers broom (*Genista*), the field sorrel (*Rumex acetosa*), the bedstraw (*Galium aparine*), the burning bush (*Euonymus*), the poppy (*Papaver*), the pigweed (*Chenopodium*), the shepherd's purse (*Capsella bursa-pastoris*), the dahlia (*Dahliæ*). They also show that not only is it not confined to a single species, or a single genus of plants, but feeds alike on those belonging even to different orders, thus setting at naught what is considered as an inflexible rule in regard to all other species. I think it more than probable the facts presented by this will ultimately lead to a more thorough examination of other species, and show that many which are now considered as distinct species are but varieties.

It may be asked, How is it known that these various supposed species are but varieties of but one species? By the peculiar marks and characteristics which distinguish it from all other species. Yet it it is possible that some of these are after all distinct, and that Koch is right in restoring them to their position as such.

Winged females glossy black, one-twelfth of an inch to the tip of the abdomen, and one-sixth of an inch to the tips of the closed wings; antennæ shorter than the body, (Dr. Fitch says half the length of the body, but this appears to be the minimum, as it is sometimes nearly as long as the body,) indistinctly seven-jointed, third longest, sixth shortest of all, except the first two. The ovipositor distinct; honey-tubes, short but distinct. Legs black tibiæ pale. Wings pellucid, veins slender and dusky, third vein abortive at the base.

The wingless females are also black; the abdomen frequently showing witish powdery dots along each side of the back. It is the pupa that presents the peculiar and marked character of the species. When this state is fully attained it equals in length the body of the winged individuals; is oval in shape, with the sides nearly parellel, the anterior end bluntly rounded and the end of the abdomen tapered to an obtusely attenuated point. The head varies in color, from black to dull green or olive, dusted over with white powder; thorax, with the anterior half, narrow, black and powdered; posterior half twice the width of the anterior part, dark greenish or olive color; the abdomen black, with white pruinose (or powdered) spots along each side of the back. The eggs, when first deposited, are greenish, but soon become black; are very minute, regularly oval, and not more than one fiftieth of an inch long.

---

* Note.—Koch has removed several of these as distinct, and Walker has accepted the change in the supplement to his catalogue.

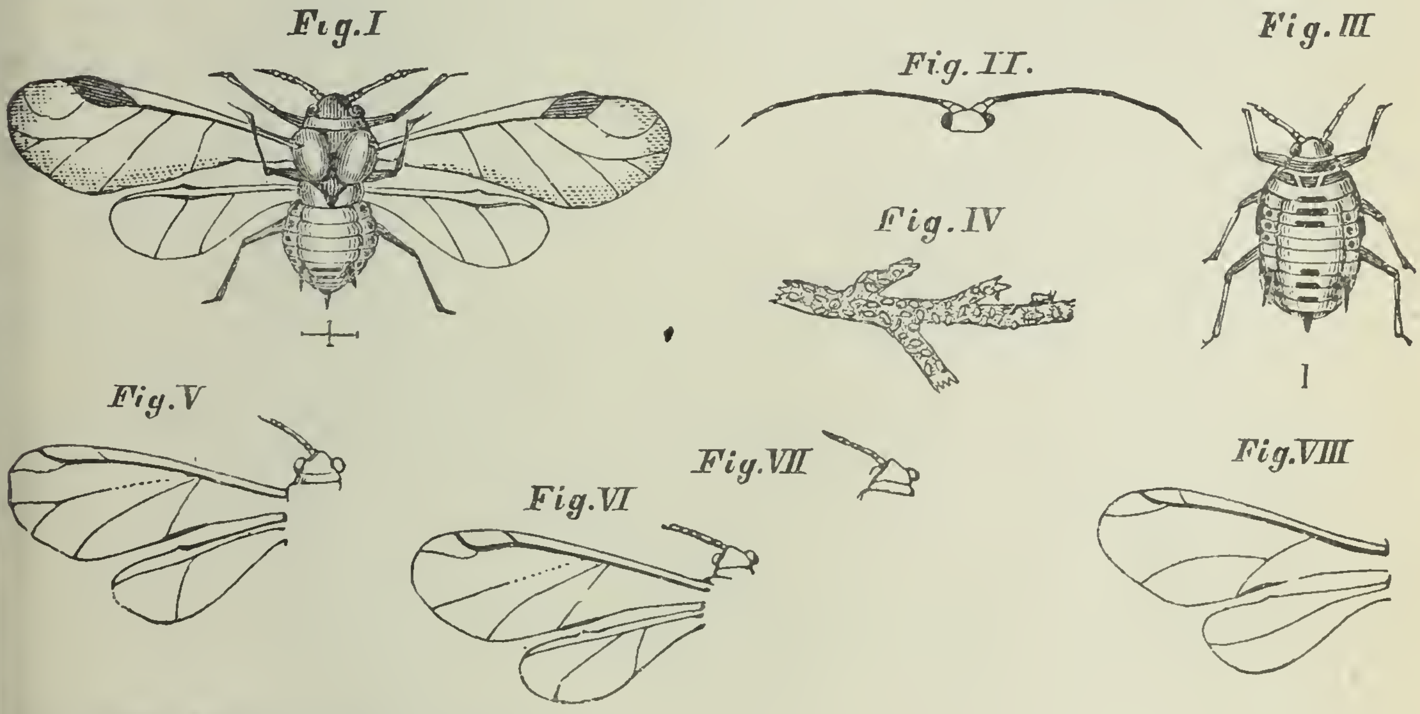
These insects usually select the center of the underside of the leaf as the point for locating colonies, which usually consist of but, comparatively, few individuals. Dr. Fitch thinks this species passes the winter in the perfect winged state, as well as in the egg state.

Aphis circæzandis. Fitch.

This is a species found on the leaves of *Galium circaezans*. Length about one-eight of an inch to the ends of the wings; head and thorax, black; wings pellucid.

I know nothing further in reference to this species as I have not seen it.

Fig. 14.



I. *Aphis maidis*—winged insect.
II. Head and antennæ of *Aphis mali*.
III. *Aphis maidis*—wingless female.
IV. Portion of a corn root infested by *A. maidis*.
V. *Glyphina ulmicola*.
VI. *Pemphigus populicaulis*.
VII. Should be omitted.
VIII. Wings of Phylloxera.

Aphis maidis, Fitch. The Maize or Corn Aphis.

This species, which appears to be different from the one infesting the Maize or Indian corn in Europe, was formerly supposed to confine its attacks to the stem or peduncle which bears the ear, the most vital point, so far as yield is concerned, of the entire plant; but Mr. Walsh afterwards found Aphides infesting the roots, which having reared to the perfect or winged state he was satisfied belonged to this species.

Fortunately I have had an opportunity during the past year of studying this species and of adding further evidence on this point and also some new facts in reference to its habits.

I give first the characters as presented by Fitch and Walsh, and also a description from specimens I obtained during the summer from a different part of the plant.

Dr. Fitch's description of those he found infesting the ear-stalks is in substance as follows:

The larvæ are either green or yellow; the latter being those which ultimately acquire wings; before changing into pupæ, they usually acquire a pale reddish color, and are dusted over with white powder. The wingless females are dull blackish, tinged with green, and sprinkled with fine whitish powder; head and generally two bands on the thorax, black; the abdomen is usually marked with black spots along the sides; honey-tubes rather short; antennæ black, and not more than half as long as the body. Winged females, similar; length of the body, six-hundreths of an inch; general color, black; the abdomen dark greenish, with black dots along each side and three black bands at the tip.

Mr. Walsh describes those he found infesting the roots as having the general color, both of the pupa and perfect insect, pale green; the female pupa usually has three, short, transverse dark lines on the thorax, and three similar ones on the abdomen. It is figured in the fifth volume of the Transactions of the Illinois State Agricultural Society. (I. fig. 14.) The antennæ are unusually short, scarcely reaching the tip of the thorax; the honey-tubes are also rather short; the first discoidal vein is farther from the second than the second is from the third, and the stigma is prominent and pointed at each end. He states that the pupa is dusted over with a whitish bloom like that of a plum, and with dusky markings.

In the latter part of July I found an Aphis feeding on the tassels of corn, which upon examination I found to belong to this species; late in the season other specimens were sent me in alcohol, which had been gathered in May in large numbers on the roots of corn. These, although in the pupa and larva state, showed so clearly the marks and other characteristics mentioned by Mr. Walsh, that there was no mistaking their identity.

It is therefore quite certain that this species is not confined to any one part of the plant, but infests the greater portion of it, at least its most vital parts, and when very abundant, as it is in some cases, does serious injury. The root variety appears to retain the pupa form for some time, and I think it more than probable that many of them never acquire complete wings, although the wing-cases are formed.

I add here a description of the specimens found on the tassels.

Wingless individuals. (III. fig. 14.)—The full grown are of an apple green color throughout except the front of the head, which is dark; honey-tubes short, cylindrical, not reaching quite half way to the tip of the abdomen, deep black with small black spots surrounding the base, body elliptical or slightly ovate in outline and of but moderate width; the very young have the sides nearly parallel; antennæ half scarcely the length of the body, dark brownish 7-jointed, third joint the longest, about equal in length to the fourth and fifth united, fourth, fifth and sixth nearly equal in length, seventh a little longer than the sixth; whole antennæ having a few scattering hairs. A stripe running along the margin at each side of the abdomen of a little darker shade than the central portion; legs dusky, darker at the joints and tips.

Winged individuals.—Head and thorax of a shining black; abdomen pale greenish-yellow, dotted along the lateral margin with black; honey-tubes black, similar to those of the wingless individuals; legs dusky. pale at the immediate base; antennæ about half the length of the body; beak very short, scarcely reaching beyond the base of the fore legs. Wings erect in repose, of usual form, third discoidal vein twice forked, transparent; veins slender, slightly dusky, the stigma elongate fusiform and rather slender; the subcostal vein for some distance from the base recedes somewhat from the costal and then at about two-thirds the distance approaches the costa; the first vein about three times as far from the second, at the tip as it is at the base; the second is slightly farther from the base of the third than the base of the first. The second fork arises near the apex of the wing; the stigmatic vein curves somewhat sharply at the base, and then is nearly straight to the tip,

The following notes received in reference to this species in 1877 are appended.

E. Hall, Athens, Menard county, July 16, 1877: "Plant lice on the roots of corn did considerable damage in 1874. Not perceptibly injurious since; and then confined to limited areas, on old lands."

E. R. Boardman, M. D., Elmira, Stark county, Nov. 27, 1877: "On the 19th of May, one of my neighbors came to get me to go and examine a field of corn that he said was being destroyed by something, and he could find nothing that could account for it. I found the corn about three inches high, and hundreds of hills withering and dying; and on careful examination I found the roots and base of the culm below the ground literally swarming with Aphides. I think from some hills I could have gathered a teaspoonful of the little creatures. I estimated about one-fifth of the stand of corn in that field to be then destroyed by them. There had been a crop of rye raised on the ground the season previous. I had before seen slight injury from Aphides, but nothing to compare with this."

The same, under date of December 5, in answer to some inquiries. "I find, on referring to my notes, the specimens sent were collected on the 22d day of May. The field was planted the 10th of May."

The same, under date of December 12. I had intimated in reply to one of his letters, that it was rather singular that they should appear there in such numbers when corn had not been raised on the field the previous season. He says:

"In regard to those Aphides, it appeared singular to me that they should exist in such numbers in that field, while in an adjoining field, separated only by a road, there were only a very few specimens found, and no injury sustained from them. This adjoining field had been cultivated in corn for several years; and the only way that I could account for it was, that the field where they were found had a hazel copse along one side of it, and that they may have come out of that, as they were worse on that side of the field."

APHIS BRASSICÆ, Linn. The Cabbage plant-louse.

A careful examination of our species during the past summer, and a comparison with carefully colored figures of the European species, have satisfied me that the two are identical. It must have been introduced at an early day, as Dr. Fitch has shown conclusively that it was known in this country as early as 1791. It is the most common and, perhaps, the most injurious species known to the vegetable garden in this country.

As a general thing, it is not considered necessary to adopt any measures for its destruction, but occasionally it multiplies to such an extent as to inflict serious injury upon the cabbages and even to destroy them. But I am inclined to believe it often does more damage than it has credit for, as it not only congregates on the under side of the outer leaves, but also on the upper side of the inner leaves, and by drawing the juices from the latter prevents the formation of firm heads. It is well, therefore, to take measures for ridding the plants of them whenever they attack the inner leaves in numbers sufficient to affect their healthy and proper growth. The injury may not be observed at the time, but afterwards the gardener may find that notwithstanding their apparent healthy condition, they have failed to form firm, compact heads, upon which their value depends. These insects may be found from July to the close of the growing season. In a short time after their appearance, they can be observed in all their stages, from the larvæ to the perfect state, with here and there among them a winged individual.

The *wingless individuals*, which are usually located in clusters, are a little less than one-tenth of an inch long, ovate in form, and of a pale pea-green or greenish-yellow color; more or less covered with a fine pale bluish white powder; the antennæ are not quite as long as the body, of sometimes a pale dusky color, but in many specimens they are more or less whitish; legs usually of a dirty yellow or somewhat dusky; the abdomen is sometimes marked with dark dots along the sides; honey-tubes short, not extending half way to the tip of the abdomen, black; tail very short, usually pale.

Winged individuals about eight hundredths of an inch to the tip of the abdomen, fourteen hundredths to the tip of the wings. General color yellow or greenish-yellow; head, black; neck with whitish powdered ring; a narrow transverse dusky ridge on the proxthorax; the raised lobes of the thorax dark; abdomen pale yellow, sometimes with greenish tint, with a row of black dots along the margin each side, and sometimes with some dark crosslines; honey-tubes very short, black; eyes black; antennæ dusky, about as long as the body, third joint corrugated about equal in length to the fourth and fifth united, fourth and fifth about equal in length, sixth, slightly over half the length of the fifth, seventh nearly as long as the third; from the fourth to the tip the antennæ are much more slender than the third and basal joints; wings transparent slightly smoky with slender, dark veins, the second vein about equally distant from the first and the third, if any difference slightly nearer the third, first and second veins nearly straight, second fork about equally distant from the apex and the third vein, fourth vein regularly but very obtusely curved, stigma rather small, elongate, very pointed at the apex without any distinct angle, dusky; the discoidal veins are robust, dark-brown, very distinct; the costal and subcostal are usually paler.

Remedies.—Drenching with soap-suds only destroys the young, leaving the old ones to plant new colonies. Watering them with a mixture of tobacco water and lime water is strongly recommended, and is perhaps the best wash that can be applied. Suffocating them with tobacco smoke is decidedly the best remedy, that can be adopted. Dr. Fitch recommends driving short stakes into the ground and covering as many plants as possible with canvas, or old carpeting, so as to confine the smoke.

Drenching thoroughly with brine will also assist in destroying them.

APHIS CERASOFOLIÆ. Fitch.
Syn. *Myzus cerasifoliæ.* Thos.

As I have succeeded in obtaining specimens of what I am satisfied is this species, I can now complete the description. The original description by Dr. Fitch, is as follows:

"The cherry leaf plant-louse (*Aphis cerasofoliæ*) measures .08 (inch) to the tip of its abdomen, and .15 (inch) to the end of its wings, which expand .26. It is black with a pale green abdomen which has three dark green dots on each side forward of the nectaries, and above these a row of impressed deep green dots extending backwards, past the nectaries, with a deep green stripe upon the middle of the back which does not reach to the tip; the sutures are also of a deeper green color; the nectaries reach half way to the tip and are dusky, at least at their ends; the neck and lower side of the head are green; the antennæ are two-thirds the length of the body, dusky, and in young individuals, green at their basis; the short tail, pale green, its apex blackish; the legs are dull white, the feet and four hind thighs, except at their base, blackish; the wings are pellucid, the stigma salt white margined with dusky, more widely so on its inner margin, the veins black, the rib-vein white, the second fork very short.

The *Wingless females* are .08 long, egg-shaped, pale yellowish green, their abdomens coated with a white meal-like powder except at the sutures and on the medial lines, which last is deeper green, and the legs and antennæ dull white.

The *larvæ*, when young, are pea green with white antennæ, nectaries and legs. When older a deeper green stripe appears along the middle of the back, and a row of deeper green dots each side which are more or less confluent into stripes."

From specimens sent me by Prof. Bundy in alcohol, I take the following characters:

Winged Specimen.—Antennæ not as long as the body, reaching about to the base of the honey-tubes; third and seventh joints about the same length as the fourth, about three-fourths the length of third; fifth a little shorter than the fourth; sixth rather less than half the length of the fifth.

Wings transparent and delicate, veins very slender; stigma rather small, long, narrow and pointed at the ends; second fork of the third vein, much nearer to the apex of the wing, than to the third vein; fourth vein curving regularly to the apex. Beak short, reaching midway between the first and second pairs of legs. Honey-tubes not reaching to the tip of the abdomen, cylindrical. Tail sender, not more than half the length of the honey-tubes.

Prof. Bundy's note accompanying the specimens is as follows:

On *Prunus virginiana* (choke cherry), June, Sauk City, Wisconsin.

"*Female.* Abdomen dirty green, transversely barred about with darker; head and thorax dark green nearly black; eyes black; wings pale yellowish at base."

I am now well satisfied that this species of Dr. Fitch is genuine and distinct from *A. cerasi* of Fabricius. The latter as I have stated in "*Bulletin No.* 2. *State Laboratory National History*," belongs to *Myzus*, while the species here described, is certainly a true *Aphis* in the restricted sense.

APHIS APOCYNI. Koch.

Although there may be some slight differences between the plant-lice found on *Apocynum* or dogsbane in this country and those found on the same genus of plants in Europe, yet these differences are so small and the points of agreement so marked that I am forced to consider the two as identical. As described and figured by Koch, the European insect is as follows :

Winged specimens.—Antennæ scarcely reaching to the base of the honey-tubes, body rather slender, form and appearance as well as color very similar to the winged specimens of *Aphis mali* or apple plant-louse. The three branch or discoidal veins of the fore wings very nearly straight ; second fork of the third vein a little nearer the apex of the wing than it is to the third vein ; stigma long, rather slender, acutely pointed at the tip. Honey-tubes rather short, not quite reaching the tip of the abdomen ; tail distinct about half the length of the honey-tubes.

Antennæ more or less dusky ; eyes brown ; head and thorax black ; abdomen grass-green, with some fuscous shadings in front of the honey-tubes and some darker transverse stripes behind them ; honey tubes black, tail dark green ; wings transparent, with brown veins ; legs pale yellowish except the tips of the femora and of the tibiæ, and the tarsi which are dusky.

Wingless individuals,—Regularly ovate, and much broader than the winged ones, antennæ shorter, general color dark green which prevails over the body except the head, two transverse thoracic lines, and two or three transverse lines near the tip of the abdomen, which are black ; honey-tubes and tail black. Length of body about .10 inch.

The specimens which I have examined, which were found by Dr. Bundy at Sauk City, Wisconsin, on dogsbane (*Apocynum cinnabinum*), present the following characters, as shown by the alcholic specimens and notes of Dr. Bundy.

Winged specimens.--Wings transparent, veins small, the branch veins usually straight, the first and second without a bend or curve; second fork of the third vein nearer the tip of the wing than it is to the third vein; stigma rather long and sharp pointed. Honey-tubes reaching about to the tip of the abdomen, but not to the tip of the tail, rather robust. Tail about three fourths the length of the honey-tubes. Antennæ rather short not reaching quite to the base of the honey-tubes.

Wingless specimens.—Rather oval in form and broader than the winged.

The accompanying note from Dr. Bundy is as follows:

"On *Apocynum cinnabinum;* June, Sauk City, Wis. Female—abdomen dirty green, tipped with black, a few black spots above and below on the medium line posteriorly; honey-tubes black; thorax black except prothorax which is dull greenish-brown, with a narrow, transverse dorsal stripe which is black; head, eyes and antennæ black;

tarsi, joints of the legs, and the posterior two-thirds of the femora black, rest of the legs pale-greenish. Wings pale neutral tint, lighter at the base."

He does not state on what part of the plant it feeds; according to Koch, it is found on the flower stalks and even in the flower itself.

Aphis nerii? Fonscol.

Found on Oleander and other closely allied house plants.

Winged individuals.—Antennae varying somewhat in length but usually not extending quite to the tip of the abdomen; there is apparently a slight tubercle at the base indicating an approximation to *Siphonophora;* third joint but slightly longer than the fourth; fifth about two-thirds the length of the fourth and twice the length of the sixth; seventh longest, about equal to the third and sixth united; an occasional, little spine-like hair can be seen along the sides with a strong power. The second fork of the discoidal vein is nearer to the apex than to the third vein; costal and sub-costal veins nearly paralell. Tail short, rather broad, somewhat clavate and about one-third the length of the honey-tubes.

General color a pretty and bright saffron yellow; head smoky yellow; eyes black or dark brown; neck or prothorax yellow, thorax or thoracic lobes dark brown; abdomen bright yellow; honey-tubes black or dark, the base usually surrounded by a paler or whitish ring; a small dark spot on the abdomen behind the honey-tubes, and occasionally the dorsal portion sparsley sprinkled with black dots. Legs yellow, tips of the femora, the knees. and tarsi dark. Anterior wings somewhat smoky, veins somewhat slender and dark; beak pale yellowish, tipped with black. Antennae dark or blackish; tail dark brown.

Length of body .07 inch; to the tip of the wings .12 inch.

Wingless individuals.—Yellow throughout except as follows: front of the head dusky; antennæ, legs, honey-tubes and tail dark, as in the winged; the beak dusky at the tip. Antennæ not reaching beyond the base of the honey-tubes. The beak reaches to the base of the second pair of legs, in both winged and apterous. Body broadly ovate. Length of body .08 to .10 inch.

It is quite probable that the only winged specimen examined is a male, which will account for its small size. Although the lice were numerous, only one winged one was obtained when there was an opportunity for examining them.

Found on the tender branches and petioles of the oleander (*Nerium oleander*) and other closely allied plants.

I think it quite probable that this is identical with *Aphis nerii*, Fonscol, but as I have no description of that species, I have placed a mark of doubt after the scientific name.

Aphis diospyri. n. sp.

A small Aphis found on the persimmon, at Carbondale, Illinois.

Winged specimen.—Antennæ not on a tubercle, scarcely as long as the body, reaching about to the base of the honey-tubes; third and seventh joints about the same length: fourth a little shorter than the third and very slightly longer than the fifth; sixth about or slightly more than half the length length of the fifth; more or less corrugated throughout. Wings transparent, veins distinct; first and second discoidal veins nearly straight; third obsolete at the base; second fork not quite half the distance from the apex of the wing that it is from the third vein; fourth vein somewhat sharply curved near its base, but curving more gradually as it approaches the apex of the wing; stigma semi-opaque, long narrow and very acutely pointed at each end; the posterior angle, where the fourth vein arises, very obtuse. Honey-tubes of moderate length, reaching about to the tip of the abdomen, cylindrical. Tail distinct but very short, not more than one-fourth or one-third the length of the honey-tubes. Head and thorax dark; abdomen pale brownish, posterior extremity black or blackish; wings clear, veins dark, the subcostal vein, which is very robust is brownish and rather paler than the others; tail black. The color of the honey-tubes was omitted at the time notes were taken from the fresh specimens but judging from mounted and alcoholic specimens before me, I presume they are dark, as they are in the wingless. Length of body .06 inch, to tip of the wings .12 inch.

Pupa.—At the time the species was discovered quite a large proportion of those observed were pupæ. These are oblong-oval in form, and otherwise similar in color, and appearance to the wingless specimens.

Wingless specimens.—Ovoid in form, flattened above, with a depressed line near the sides forming a flattened somewhat alate margin; transversely wrinkled; more or less covered with a cottony substance; general color purplish brown.

They impart a reddish stain to the alcohol in which they are immersed.

Found on the leaves of the persimmon (*Diospyros virginiana*); chiefly on the underside. Carbondale, Illinois, in June.

APHIS VIBURNI. Scop. (Fab.) The Snowball Aphis.

This species is found according to Dr. Fitch on the fruit stems of the high cranberry (*Viburnum opulus var Americanum.*) I find it on the twigs, especially the new growth and along the mid-rib and petiole of the leaves of the snow-ball (*V. opulus* var *rosum*); Koch also speaks of its infesting the leaves.

Winged female.—Antennæ reaching nearly to the honey-tubes, dusky; entire body, including head and thorax, black or very dark-brown; with sometimes times paler transverse lines on the abdomen; legs yellow except the posterior and middle thighs and ends of the tibiæ.

Honey-tubes reaching nearly to the tip of the abdomen ; tail short but distinct. Length of body about .09 of an inch.

Wingless female.—Antennæ not more than half the length of the body, pale at base, dusky towards the tips. The form of the body is broadly oval, very convex sometimes appearing almost spherical. The general color is a lilac-brown, sometimes almost black, varying in depth of color in different parts of the body and also in different individuals; usually the head is somewhat paler than the thorax which is more or less tinged with olive; the central portions of the abdomen paler than the sides which are dark brown; tip of the abdomen, and a space around the base of the honey-tubes black or blackish. Legs mostly transparent yellow. Beak of medium length, scarcely reaching the hind coxæ.

Found at Carbondale in June and July.

APHIS VERNONIÆ Thos. The Ironweed Aphis.

This pretty Aphis is very abundant during the summer on the underside of the leaves of the ironweed (*Vernonia fasciculata*), causing them to curl downwards and inwards at the sides; it also moves on to the tender stem when abundant, and later in the season is found chiefly on the pedicels, or flower stalks, giving to the heads a blackened, sooty appearance, causing the flowers to fade and the head ultimately to wither and die. It is sometimes so abundant that its effect may be observed, over a large area thickly covered by this weed, at a glance.

I found it at Carbondale from June to August, and at Fort Dodge, Iowa, about 1st September; at the latter place it was, at the date mentioned, confined wholly to the heads. A pretty, bright, lemon-yellow species.

Winged individuals (probably females).—Length of body about .06 to .08 of an inch; to tips of wings .12 of an inch. General color bright yellow; abdomen bright lemon-yellow; thorax yellow, except the raised lobes, which, with the insertions of the front wings, are more or less dusky or brownish, in some specimens quite dark, in others pale. Antennæ about two-thirds the length of the body; honey-tubes slender, cylindrical, and reaching nearly to the tip of the abdomen; tail distinct, but short and blunt. The antennæ and honey-tubes are generally pale, the latter are sometimes ochreous, the tail yellowish or whitish; legs pale. The wings typical in venation, transparent, with a slightly smoky appearance; veins dark; a few specimens of the many examined had the wings clear, but as a rule the fuliginous or smoky appearance is very distinct; the second fork of the third discoidal vein is very near the tip and is very short.

Wingless individuals.—Almost uniformly greenish-yellow; eyes black; honey-tubes ochreous; tail whitish.

Sometimes the head, thorax, honey-tubes and tail of the winged specimens are darker than represented.

This appears to be very closely related to and probably identical with *A. beccabungæ*, Koch, which infests a species of *Veronica* in Europe; but I have concluded it best to consider it as distinct until identity has been established by better evidence than I have at present.

APHIS CEPHALANTHI. Thos. The Button-bush Aphis.

This species is found on the stem or twig of the present year's growth, and sparsely along the mid-rib of the leaf near the base; and usually, I believe, on the upper side. I am not positive in reference to this last point as my notes taken at the time omit to mention which side of the leaf they occupy, but my recollection is quite distinct as to its being the upper side. The young appear to be confined to the stem. I found them only on very young bushes but a foot or so in heigth; in the middle of July (15th to 20th).

Wingless individuals.—Of a nearly uniform purplish color, the young quite pale, the older and mature individuals darker but more or less translucent, with a slightly pruinose coating. Head and tip of the abdomen dusky; a slightly impressed line along each side of the abdomen near the margin. Honey-tubes cylindrical, reaching about to the tip of the abdomen; tail distinct; beak reaching slightly beyond the middle coxæ. Form regularly ovate; length about .05 of an inch. Eyes black. Some specimens have the front and tip either pale or about the same color as the abdomen. When crushed they give a reddish or dull orange color.

Winged individual.—(probably female). Head and thorax black; abdomen pale purplish, marked along the margin with pruinose or powdered spots, two similar spots also on the base of the abdomen immediately behind the thorax; tip of the abdomen dusky; there are about four of the lateral pruinose spots anterior to the honey-tubes on each side, and two behind them. Antennæ very slender, reaching only to about the middle of the abdomen, dusky. Legs pale except the knees, tips of the tibiæ and the tarsi, which are dusky. Wings of the usual form and venation, transparent with a slightly smoky shade when seen in their usual erect position in the living insect; the stigma pointed at the tip; fourth vein regularly curved; third vein obsolete at the immediate base; veins dark except the sub-costal, which is pale. Length of body about .06 inch; to tip of the wings, .09 of an inch.

APHIS IMPATIENTIS. Thos. The Touch-me-not Aphis

This species was found at Carbondale, Illinois, in August, infesting the wild touch-me-not (*Impatiens fulva*.) I know very little in reference to its habits.

Winged individuals. Antennæ nearly as long as the body, reaching about to the base of the honey-tubes; pale and dusky alternately; third joint pale at base, rest dark; fourth pale except at the immediate tip; basal half of the fifth pale, dark from thence to the tip of the last joint. Head black; prothorax pale brown, rest of the thorax shining black; abdomen pale brown; honey-tubes of medium length, black; tail rather short, dull yellowish. Veins of the wings brown; stigma rather large, opaque and pale brown; iridescent. Tibiæ pale yellow.

Length of body .10 of an inch; to the tips of the wings .18 of an inch.

Wingless specimens, purplish-brown. Pupæ pale brown; thorax dull yellow; wing-cases whitish; legs and antennæ pale, transparent; broadly oval in form.

This species belongs to *Aphis* in the restricted sense.

Aphis symphoricarpi. Thos. The Snow-berry Aphis.

Found on the leaves of the Snow-berry (*Symphoricarpus vulgaris*) at Ft. Dodge, Iowa, September 1st. It inhabits the underside of the terminal leaves, causing them to curl, wither and die.

Wingless individuals (no winged specimens observed.)

There appear to be two varieties, or possibly the differences are sexual. The one pale transparent green, or yellowish green, eyes black, and a black ring around the antennæ beyond the middle, and the tips dusky; the honey tubes, and a small space around the base of each, ocher-yellow; tarsi, and tip of the beak, black; legs pale transparent green; bodies broadly ovoid and very convex; abdomen very distinctly acuminate at the apex, but no tail apparent.

The other variety is rather less convex, and the dorsal surface is more or less shaded with brown; in the darker specimens this color sometimes occupies most of the back; there is usually a median line or stripe of green on the posterior half of the abdomen, which can often be indistinctly traced to the thorax; the thorax generally more or less shaded with pale brown; tip of the abdomen usually pale or greenish, and not acuminate as in the other variety; tail distinct but short, whitish; honey-tubes dark at the tips; remainder, and a space around the base, yellowish-brown.

Legs rather short. Antennæ reaching to the honey-tubes, or nearly to the tip of the abdomen; honey-tubes very short, almost reduced to tubercles, length about twice their diameter.

Aphis middletonii. Sp. nov.

This species, which is found in abundance during autumn and winter, on the roots of iron-weed, aster, and perhaps other plants, and which was discovered by me last November, is somewhat anomalous. And, although it is exactly what I have imagined for some time I would find, yet it appears no less anomalous when it is found. I cannot designate, with any certainty, the plant it chiefly infests, and hence am liable to lead astray by using a name indicating a particular plant or genus of plants. I have, therefore, named it in honor of Mise Nettie Middleton, who has been my constant assistant in the study of the Aphides, and to whose care and skill I am indebted for all the mounted and otherwise prepared specimens; who also has done a very large share of the microscopic work, and has assisted in describing and verifying a large portion of the species mentioned.

Wingless female, (no winged specimens observed).—General color of the body a leaden gray, with very little variation; antennae a little lighter than the body, with the tip of the fifth and whole of the sixth joint dark; legs the same color as the body, with the knees and tarsi dark; honey-tubes darker than the body, though having a leaden hue; tail the same color as the body; eyes black; beak with a brownish shade, tipped with black. This appears to describe the typical individuals, which seem to be fully developed; but the shading varies from this almost to white, and if the ones hereafter mentioned belong to the same species, then to white.

Antennæ seven-jointed, distinctly and unquestionably about half the length of the body; first joint very large and about twice the length of the second; third longest, but not as long as the following two taken together; fourth, fifth and sixth nearly equal in length; the sixth perhaps a little the shortest; seventh distinctly longer than the sixth but shorter than the third, being about or very little more than half the length of the latter. Honey-tubes rather short, cylindrical, reaching less than half the distance to the tip of the tail; tail quite short, conical and hairy; beak reaching to the third pair of legs; legs hairy. Form of the body elongate-oval, very convex. Length about .07 inch. With these were found others which correspond almost exactly with that described as *Tychea erigeronensis*, found by Professor Burrill on the roots of Endive and *Erigeron canadensis*, as to color, number of joints in the antennæ etc. That I now really believe, is but the larval form of this species, but have allowed the two to stand as distinct until the question as to identity, can be determined by further investigation.

That the species here described is a true *Aphis* can scarcely be doubted, as all the essential characteristics conform to that genus as restricted by Passerini. If this be so, then it is more than probable that this is but a dimorphic form assumed to adapt it to its suberranean mode of life and thus enable it to pass the winter. What it is in the winged state is as yet wholly a matter of conjecture, but that it is an *Aphis* inhabiting some composite plant is very probable. I am trying to rear it and if successful may be able to determine the question.

APHIS CARDUELLA. Walsh.

"Tips of young thistle-shoots. Blackish. Antennæ with joint six short, somewhat obtrigonate; joint seven as long as five and six put together. Honey-tubes as long as the tarsi. Legs rather short, pale greenish; knees, tips of tibiæ and tarsi dusky. Wings hyaline, with the tips of the front wings slightly fumose; veins brown, yellowish on the costa, the third discoidal hyaline at its origin; stigma pale, dusky brown. Length to tip of the wings 0.9—.10 inch."

"On *Cirsium altissimum*, and an undetermined species same genus. Antennæ attain the origin of the second discoidal vein when the wings are expanded, and the stigma is rather more than twice as long as wide and hunched on the exterior margin." (Walsh).

APHIS SAMBUCI. Linn. The Elder Aphis.

Syn. *A. sambucifoliæ?* Fitch.

I think it more than probable that Dr. Fitch's species is identical with or but a variety of Linnaeus's species, and therefore give them as one here. The European insect is nearly black, a tinge of dark green showing on the abdomen. In the winged female the antennæ are about as long as the body, slightly shorter in the apterous individuals; seventh joint very slender and longer than the third. Honey-tubes long for this genus, extending beyond the tip of the abdomen. Legs somewhat hairy; thighs and tibiæ pale at base, black at the tips. Antennæ and honey-tubes black. Size, rather large; length of body .10 to .12 inch.

Dr. Fitch discribes his species very briefly as follows: "Black; tibiæ and base of femora pallid; stigma, dusky; nerves black, the furcate one hyaline at its base. Length .15. On the underside of the leaves of the elder. Male."

The measurement doubtless means to the tips of the folded wings. It is also more than probable the specimen described was a viviparous winged female.

I have not been fortunate enough to find this or either of the two following species, and hence can not decide with certainty as to their proper position.

Aphis cornifoliæ. Fitch. The Dogwood-leaf Aphis.

It inhabits the underside of the leaves of the Dogwood (*Cornus paniculata*).

The apterous females are black, somewhat powdered or mealy, and obovate in form: legs pale yellow, feet black; antennae pale yellow, with the tips black; honey-tubes reaching nearly to the tip of the truncated abdomen. Length, .05 of an inch to the tip of the abdomen. (Fitch.)

This is evidently different from the *A. corni* of Fabricius which belongs to another sub-family.

Aphis cratœgifoli. Fitch. The Thorn-leaf Aphis.

Found on the leaves of the Thorn (*Crataegus punctata*) which it corrugates. Black; abdomen, with a row of blackish dots along each side; veins of the forewings whitish, black at their tips; tibiæ or shanks, except at their tips, and base of the thighs, green; honey-tubes, equaling nearly half the distance to the tip of the abdomen. Length, .15 of an inch. (Fitch.)

The length given here by Dr. Fitch I am satisfied is to be understood as to the tips of the closed wings.

This species is certainly different from *A. cratœgi* of Kaltenbach, or the *A. pyri* Fonscol. with which it is supposed to be identical; it agrees with *A. cratœgi*, Koch in the length of the honey-tubes, but in nothing else. I think therefore that it is a distinct and true species.

Aphis medicaginis. Koch.

As I am informed by Mr. J. Monell, of St. Louis, that he has found this species on *Leguminosœ*, I insert it here, with a brief description from Koch, as I have not seen it.

Winged viviparous female.—Size, small. Antennæ scarcely reaching to the base of the honey-tubes. Honey-tubes not attaining the tip of the abdomen; tail rather prominent. Body black throughout; antennæ pale, dusky at the tips.

Wingless female.—Rather broadly ovate; antennæ not more than half the length of the body. Color as in the winged female; tail in both black.

APHIS AMYGDALI. Blanch. The Almond Aphis.

I know nothing personally in reference to this species. I find it stated that it is much smaller than *Myzus persicae*, is found attached to the underside of the leaves of the almond and peach trees, causing them to crisp and wrinkle.

The body is green; antennæ brownish; the legs are green except the tips of the thighs and tibiæ, which are yellowish; wings pellucid and very long, veins pale yellow or greenish.

APHIS POPULIFOLIÆ. Fitch. The Poplar-leaf Aphis.

Inhabits the underside of the leaves of *Populus granidentata*. Of a chestnut brown color, mealy; legs hairy, black, pale brown above the knees; veins of the fore-wings brown, stigma smoky yellow, margined with black; back with two rows of impressed, squarish fuscous spots; on each side, two rows of impressed dots; honey-tubes equaling a third of the distance to the tip. Length to tips of wings 0.22 inch.

APHIS PINICOLENS. Fitch. The Pine inhabiting Aphis.

Found solitary on the Pine. Straw yellow, densely covered with white powder; antennæ black, bases pale, with a dusky ring; fore-wings with a fuscous spot on the tip of each vein; veins brown, hyaline at their bases, the costal one straw yellow; honey-tubes very short. Length to tips of wings 0.25 inch.

This probably belongs to another genus, but I am unable to place it from the short description given by Dr. Fitch; such is also the case with reference to the preceding species which possibly belongs to *Chaitophorus*, and may be identical with my *Ch. populicula*. I give them as I find them with the hope that some one into whose hands this report falls may be able to settle this point satisfactorily by finding the species.

GENUS CHAITOPHORUS. Koch.

This genus is distinguished by the following characteristics:

Front wings with three discoidal veins, the third twice forked; the posterior wings with two branch veins. Antennæ seven-jointed, not on tubercles, of medium length, usually a little shorter than the body, pilose or hairy; the seventh joint setaceous and longer than the sixth. Honey-tubes tuberculiform or obsolete. Beak of moderate length. Body usually hairy, and sometimes roughened by small tubercles.

CHAITOPHORUS NEGUNDINIS. Thos.

Winged Individual (in glycerine).—Wings very thin and delicate, and veins very slender; the costal vein bends outward from the base to the insertion of the second discoidal vein; the stigmatic vein starts from the stigma far back near the middle, curves slightly and gradually for a short distance and is then almost straight to the apex of the wing; stigma very long and slender; veins and stigma pale yellowish. Antennæ nearly as long as the body, sparsely covered with long stiff hairs. Honey-tubes short. Apparently greenish.

Found at Peoria, Illinois, in June, by Miss Smith, on *Negundo aceroides* (box elder).

CHAITOPHORUS POPULICOLA, Thos.

Winged specimens. Antennæ not very long, somewhat hairy. Wings transparent, but along each discoidal vein there is a broad smoky border; stigma dark; when examined by a strong power the wings appear to be covered with scales; when examined by an ordinary pocket lense they present a very pretty appearance, as though marked by dark cross bands. Head and thorax shining black; neck dull yellowish; abdomen yellowish, with some irregular dusky patches toward the tip. Antennæ, which reach about the middle of the abdomen, dusky, the basal half paler; legs dark, the bases of the femora pale; beak short, reaching only to the middle coxæ.

Apterous female. Reddish-brown, or tortoise-shell color; a large, yellowish, triangular or Y-shaped spot, (the forks pointing backward) on the middle part of the abdomen; honey-tubes reduced to simple tubercles, yellow. There is often a palish stripe along the middle of the head and thorax. Antennæ pale yellowish at the base. Length about .05 of an inch.

Body more or less hairy; and although my notes, made at the time, fail to mention the fact, I think that some, at least, of the apterous specimens were covered with tubercles.

Found in July, at Carbondale, Illinois, and the first part of September, at Dubuque, Iowa, on the under sides of the leaves of young sprouts of *Populus angulata* (cottonwood).

CHAITOPHORUS LONICERA. Monell (Mss.)

This and the two following species were discovered and named by Mr. J. Monell, of St. Louis,* to whom I am indebted for a specimen of this species and the brief characters given of the other two. He also included another species which I have referred to *Callipterus* as I am satisfied it belongs there.

The characters given in Mr. Monell's brief notes are as follows: "Wings hyaline; honey-tubes almost on a level with the abdomen, detected with difficulty; abdomen pulverulent with short tubercles on the edge."

From the dried specimen with which he favored me, I make out the following characters:

Winged female. Wings as usual in this genus; third vein obsolete at the immediate base; second fork rather nearer to the apex than to the third vein; fourth or stigmatic vein curved at the base but the apical half is nearly straight; veins very delicate; wings also very delicate, but slightly smoky. Antennæ longer than the body; third joint long and pustulated; seventh nearly or quite as long as the third. Honey-tubes reduced to mere tubercles. Beak reaching to the third pair of legs. Body greenish.

This is certainly different from *Rhopalosiphum lonicera*, Siebold—which has the honey-tubes distinctly enlarged in the middle, and reaching nearly to the tip of the abdomen.

On the honey-suckle (*Lonicera.*)

---

*NOTE.—This and other species named by Mr. Monell are noticed in the appendix.

CHAITOPHORUS VIMINALIS. Monell.*

Wings hyaline: honey-tubes distinct. Not pulverulent. Seventh joint of the antennæ long. General color of the winged specimens dusky, with the margins of the abdomen yellow.

Found on the willow.

CHAITOPHORUS SALICICOLA. Monell.*

Wings hyaline; honey-tubes distinct, fusiform; not pulverulent. Seventh joint of the antennæ short. General color red.

I give this on Mr. Monell's authority but I would not be surprised if it proves to be but a variety of Uhler's *Lachnus salicicola* which is hereafter described.

CHAITOPHORUS CANDICANS (?). The Balm of Gilead Plant-louse.

Infests the base of the leaves of the Balm of Gilead, and appears to be different from the *A. populi*, of Linnæus. But in order that this may be determined, I give here briefly, the characters of the latter, which has been transferred by Koch to his genus *Chaitophorus*.

The rib vein hardly approaching the front border, and then very slightly diverging from it; its angle very blunt and scarcely perceptible; the first discoidal vein very oblique to the rib vein, from its source to the base of the wing is less than three-fourths the distance from its tip to the base of the wing; second vein more oblique than the first, more than three times as far from the first at the tips as at the base; the third vein obsolete at the base.

The position of the rib-vein, the obliquity of the discoidal veins, and the absoleteness of the third at the base, together with a slight difference in habits, are doubtless the reasons why this has been removed to another genus.

GENUS MYZOCALLIS. Pass.

This genus which was evidently formed by Passerini to include some osculent species pertaking of the characters both of *Chaitophorus* and

---

* NOTE—See Appendix.

Callipterus has really no characters. But as I have elsewhere stated the present restricted genera of the Aphides are largely artificial and must remain so until the life history of the species is better known. I use the genus here in a slightly different and more districted sense than its author, who brings together here *Aphis coryli.* Kalt and *Chaitophorous ononedis.* Kalt. The former which he gives as the type I take as a guide; the latter is evidently a species of *Chaitophorus.* His *Pterocallis* is dispensed with and the species which would be placed in it are referred to *Callipterus.*

The characters may be given as follows: Front wings with the third discoidal vein twice forked; posterior wings with two discoidal veins; antennæ not on a tubercle, smooth, seventh joint longer than the sixth; honey-tubes tuberculiform or sub-obsolete.

Very closely related to *Callipterus*, and from which it is chiefly separated by the comparative length of the sixth and seventh joints of the antennæ.

It would probably be as well or perhaps better to refer the species of this genus to *Callipterus.*

MYZOCALLIS BELLA. Walsh.

Syn. *Myzocallis guercicola.* Thos. *Mss.*
Apthis bella. Walsh.

The following species of plant-louse is described from specimens found by Prof. Bundy in Wisconsin, and by myself in Illinois. It is possible the two are not identical, but as they appear to be, I describe them as such, giving the description of both, that the reader may be able to determine for himself.

Specimens from Prof. Bundy:

Winged individuals. (Alcoholic and somewhat imperfect).—Body somewhat fusiform in outline, honey-tubes very short, the length but little more than the diameter; slightly swollen at the base. Antennae wanting in all the winged specimens. Wings, with third discoidal vein of the front pair, twice forked; posterior pair with two branch or discoidal veins. In the anterior pair the first vein is about twice the distance from the second that the second is from the third, and curves regularly though slightly inward as it approaches the margin of the wing; second vein very distinctly sinuate; third vein slightly sinuate also. Second fork of the third vein about equally distant from the apex and from the third vein. The fourth, or stigmatic vein curves sharply the first half of its length, and then runs straight to the margin, but diverging somewhat rapidly from the fork of the third vein. Stigma acutely pointed at the apex, very obtusely angled posteriorly at the point where the fourth vein arises.

General color of those specimens which have been immersed for a long time in alcohol, pale, dull yellow; the abdomen shows some partial, transverse, dark stripes on each side. Wings very thin, transparent, the veins dark brown, slightly margined with brown, which expands at the points where they reach the margin, giving the wing a very pretty appearance when seen through an ordinary pocket magnifier. The stigma is semi-transparent and pale in the middle, but is crossed obliquely at each end by a brown band: The costal and subcostal veins dark brown and remarkably parallel from the base to the stigma. In another specimen the brown bordering to the veins is almost obliterated.

Pupa?—Antennæ seven-jointed, if on a tubercle this is not very apparent, but appears to be indicated in some specimens; third joint nearly as long as the fourth and fifth united; fifth a little shorter than the fourth; sixth a little over half the length of the fifth; seventh about as long as the fourth, cylindrical but not tapering; in the alcoholic specimens pale with dark wings at the joints. The two basal joints of the antennæ have a strong spiny hair on the inner margin, the front of the head bears a few similar hairs; the body, especially the abdomen, more or less hairy, these hairs being more or less capitate.

Honey-tubes short, the length scarcely equaling the diameter. The body fusiform, abdomen rather small and tapering. Alcoholic specimen pale yellow; eyes red.

It is barely possible that the specimen here described as a pupa is in fact, a wingless adult.

Wingless specimen.—Hairy, and in this respect similar to the pupa? (winged specimen not hairy). Antennæ nearly as long as the body; in what is described as the pupa they are longer than the body. The abdomen large in proportion to the rest of the body, and instead of tapering from the base enlarges to the middle, and gradually rounds to what appears to be a broad tail.

Size; length of body of winged specimen, .06; to tips of wings .11 inch.

Prof. Bundy says in reference to them: "Female, pale yellowish, abdomen with a transparent greenish tinge slightly orange on the head and thorax. Found at Sauk City, Wisconsin, on the oak, in June; scattered:

I think there can be but little doubt that the specimens here described belong to Mr. Walsh's *Aphis bella.* For the purpose of comparison, I add here the original description of the latter:

"*Aphis Bella.*—Oak leaves? Bright yellow. Eyes black; antennæ with the tip of joints 3-6 black. Prothorax as long as the head with a lateral black vitta; thorax with a black vitta extending from its anterior angle to the base of the front wing. Honey-tubes scarcely as long as the tarsi, generally immaculate, sometimes tinged with fuscous. Legs long, black except the base of the femora and the coxæ. Wings hyaline; front wings with the entire costa as well as its nervures black to the tip of the stigma, whence there extends a marginal dusky vitta, as wide as the costa at base and middle but tapering at tip, nearly as far as the middle branch of the third discoidal vein; this vitta covers the entire length of the fourth or stigmal vein, which terminates half way between the tip of the stigma and the apex of the wing, is slightly and gradually curved, and encloses a marginal cell not wider than the costa; hind wings with a costal dusky vitta extending to the tip of the wing, the sub-costalvein sometimes black; remaining veins of both wings slender and pale-dusky, narrowly bordered with sub-hyaline where they traverse the terminal dusky vitta of the front wing. Length to tip of wings .15 inch.

"The antennæ attain the middle of the stigma when the wings are expanded, and the stigma is rather more than three times as long as wide, not very acute at each end."

The 22d of May, 1878, I discovered, at Carbondale, Ills., on the leaves of the burr oak (*Quercus macrocarpa*), plant lice, which I am inclined to believe belong to the species just described. In order that the reader may be in possession of all the facts concerning the species, I add here a description of these specimens.

Winged individuals (the only kind seen)—rather slender, of medium size; the body and all the parts except the wings a pretty creamy yellow color; the wings thin but clouded with fuscous, which is very distinct in the hiving insect while the wings stand erect above the abdomen; these fuscous or cloudy spots appear to fall chiefly into two irregular oblique bands, one rather in advance of and the other behind the stigma, but when a single wing is examined this arrangement will scarcely be observed. Costal and sub-costal veins of the front wings close together and parallel throughout; second discoidal vein decidedly sinuate and much nearer to the third than to the first; third obsolete at the immediate base, curving somewhat strongly outward as it approaches the origin of the first fork; second fork rather nearer to the apex of the wing than to the third vein but difference slight; fourth vein very sharply curved throughout so that its middle portion approaches much nearer the first fork than its ends. Antennæ longer than the body, slender; third joint longest; fourth a little shorter than the third; fifth a little shorter than the fourth; sixth about half the length of the fifth or less; seventh in the only complete antennæ obtained, about as long as the fifth. On most of the specimens I was unable to observe any honey-tubes; but in one specimen found on the same leaves and which appears to belong to this species, these were apparent but very short, their length scarcely exceeding their diameter. This specimen was of the same delicate yellowish color, but the wings were perfectly pellucid. It is impossible to decide in reference to the honey-tubes from the mounted specimens which are imperfect.

On one of these specimens I found a species of mite fastened to the metathorax or base of the abdomen so as not to interfere with the flight of the Aphis. It is probably a species of *Trombidium* but as it is evidently in its larval state it is difficult to assign it to its proper position. It is probably the young of Dr. Packard's *T. bulbipes* but it differs from that species in not having the tarsi enlarged; it also has the tarsi furnished with two strongly curved claws.

It is possible that this is Dr. Fitch's *Lachnus quercifoliæ* but it is impossible to identify the two from his very brief description. It approaches very nearly to *Aphis quercus*, Kalt, which Koch has placed in *Callipterus*, and I would have identified it with that species but for the clouded wings. It will fall in *Myzocallis* as I have given the characters of that genus, and is probably a variety of the species under which I place it.

MYZOCALLIS HYPEICI. New sp.

Found on St. Johnswort, Carbondale, Illinois, in April.

Winged individuals.----Wings pellucid, veins slender and pale brown; third vein obsolete at the base; second fork nearer to the apex of the wing than to the third vein; fourth vein curves somewhat rapidly near the base and then is nearly straight; stigma not very distinct, posterior angle distinct but very obtuse. Antennæ not quite as long as the body; third joint longer than the seventh which is about the same length as the fourth; fourth and fifth about equal, each nearly as long as the third; sixth about half the length of the seventh. Similar in color to the wingless but rather darker. Anterior femora and the tibiæ of all the legs pale; eyes black. No honey-tubes visible; beak reaching nearly to the base of the third pair of legs.

Wingless individuals.—Purplish, pruinrose or covered with a powdery substance, margin of the abdomen expanded, with a row of black dots along the sides. Indications of very minute, black honey-tubes, but these are more apparent than in any other specimens. Tarsi, knees and tips of the antennæ dark. Antennæ a little longer than the thorax.

Found on *Hypericum prolificum*, on the leaves and their petioles. Size small.

In some of the specimens the second fork presents a very distinct fork. The seventh joint in this species is really but a long spur to the sixth, a strong power showing that there is no articulation between the two in specimens rendered translucent by long immersion in Canada balsam. But after all is this not true in reference to the *Aphidini?*

GENUS CALLIPTERUS. Koch.

Passerini and Buckton place this genus in *Lachnini* which group they characterize as containing species with six-jointed antennæ. Koch also gives it the same position in his tabular arrangement, but in the body of his work this arrangement appears to have been abandoned in some respects, and there the genus is placed in advance of *Lachnus*. The antennæ are in fact seven-jointed counting the portion beyond the offset at the end of the sixth as a joint, as is done in the other *Aphidini*.

Characters.—Front wings with the third discoidal vein twice forked; posterior wings with two discoidal veins. Antennæ seven-jointed, not on tubercles, third joint longest; seventh joint shorter or not longer than the sixth, sometimes appearing as but a spur to the sixth. Honey-tubes short, sometimes sub-obsolete. The beak short or of but medium length. Antennæ and body smooth. Wings usually very thin and delicate, the veins sometimes margined with fuscous, sometimes very slender; third discoidal vein sometimes arising at or unusually near the base of the stigma; wings sometimes clouded. Color usually pale yellow or pale brown.

This is evidently an osculant group connecting the true *Aphidini* with the *Lachnini*, I have placed it at the end of the former tribe in preference to placing it at the commencement of the latter, as this appears to be the more natural position for the species.

By this transfer the necessity for Passerini's genus *Pterocallis* is entirely obviated.

I think it quite probable that when the history and habits of this species become better known, and a natural grouping of species is undertaken, that it will be found necessary to bring together most of the species of *Callipterus*, *Myzocallis*, *Pterocallis* and *Hyalopterus*. Mr. Walsh's genus *Calaphis* is evidently founded on an abnormal species, which I think beyond question belongs to the present group---either to this genus or *Myzocallis*.

The absence of the fourth or stigmatic vein occurs occasionally in this group. By placing the wing under a strong microscope the line of the vein can be traced by an almost imperceptible row of minute hyaline dots.

CALLIPTERUS BETULÆ? Koch. The Birch Aphis.

Aphis betulicolens? Fitch.
Calaphis betulella? Walsh.

I am not positive that the species here mentioned are indentical but have concluded it is best to so consider them until further investigations shall determine this question.

Koch's species is more than usually large which agrees with the measurement given by Dr. Fitch, of his species. The winged female is greenish yellow; antennae and lobes of the throax black; head brown; legs dull yellow, except the shanks and tarsi of the front pair which are dusky; the veins of the wings dark except the subcostal, which is greenish yellow. The antennae are long reaching beyond the tip of the abdomen; wings large; honey-tubes obsolete; body slightly hairy; legs quite long.

Dr. Fitch describes his species as follows:

"Sulphur yellow; antennae deep black except the two basal joints, which are sulphur yellow; the following joints are white at the base. Nerves of the forewings black, the costal sulphur yellow, the base of the forked vein hyaline; stigma transparent yellow. Honey-tubes very short. Length, .18 inch," [to tips of wings.]

This is certainly not the *Aphis betulæ* of Linnæus.

Mr. Walsh's species may be distinct but I doubt it very much; the absence, or apparent absence, of the fourth vein is not unknown in this group, and if of any value must as he argues, place it in a different genus.

He describes his species as follows:

"*Calaphis betulella*—Yellow. Antennæ attaining the extreme tips of the expanded wings, black, joints 1 and 2 yellowish with a black vitta half inside and half beneath; joints 3–6 each white at base; eyes black, with a black line from each to the insertion of the rostrum, which is black; head with a narrow black vitta above, acute in front, commencing between the antennæ and attaining the prothorax. Prothorax and thorax with a narrow lateral vitta commencing at the eyes, passing just inside the base of the wings, and converging on the scutel, and another dorsal one, black. Abdomen with about seven dorsal black fasciæ at the tips of the joints, the basal and several of the terminal ones often interrupted or obsolete, occasionally only three present. Honey-tubes fuscous, scarcely as long as the tarsi. Legs yellow, femora with an anterior black vitta, abbreviated at tip, and a terminal and subterminal black faciæ above; tibiæ and tarsi black. Wings hyaline, stigma generally yellowish; subcostal and three discoidals coal-black, very robust, subequal, except at the origin of the third discoidal where the subcostal is fine and paler, and the third discoidal hyaline for a short space, whence it becomes obsolete. Hind wings with all the veins slender, subhyaline. Length .07–.09 inch; to tip of wings .15–.17 inch, expanse .30–.35 inch.

The stigma is three times as long as wide, moderately acute at each end.

Antennæ long, linear, seven-jointed; 4 shorter than 3, 5 shorter than 4, 6 less than one-half as long as 5, 7 slender, twice as long as 6. Prothorax more than half as long as the thorax. Honey-tubes moderate. Wings steeply roofed and differing from those of *Aphis* only in the total absence of the fourth or stigmal vein and in the unusually robust discoidal veins."

This description would, according to the characters given, place this species in *Myzocallis*, but I prefer to allow it to remain until the question of identity can be positively determined.

CALLIPTERUS ULMICOLA n. sp.

This exceedingly delicate species I find in the collection of Plant-lice sent me by Prof. W. T. Bundy, of Sauk City, Wisconsin, the accompanying note, which is given below, is too brief to aid much in determining it. I am forced therefore, in describing it, to rely upon the characters shown in the alcoholic specimens, with the exception of the general color.

Winged specimen.—Wings exceedingly delicate and transparent, appearing as a mere film, even the veins scarcely visible with a common pocket magnifier, when seen through a strong microscope the latter are pale transparent yellowish; the subcostal much the largest, and nearly parallel with the costa, bending slightly inward at the insertion of the first branch vein, which is farther from the base of the wing, and nearer the stigma than usual, it also makes a sharp curve forward toward the costa at the base of the stigma; the second vein rises about the base of the stigma, it and the first vein both curve somewhat strongly outward (toward the apex of the wing) at base;

third vein, which is twice forked, arises apparently from the stigma, but is obsolete or nearly so at the immediate base. The fourth vein is nearly obsolete, when seen under a strong microscope it is represented by a series of points; curves regularly but not sharply. Stigma rather broad, somewhat hatchet shaped, widening toward the apex, with a distinct angle at the point where the fourth vein arises. The second fork of the third vein about equally distant from the apex and third vein. Posterior wings with two branch veins. Antennæ not on a tubercle, about as long as the body; third joint long; fourth about three-fourths the length of the third; fifth fully as long as the fourth, and about twice the length of the sixth, which is a little longer than the seventh. The whole antenna is quite slender. Honey-tubes imperfect in all the winged specimens, but appear to be very short, length not exceeding the diameter.

Wingless specimen.—Front of the head rather obtusely advanced in the middle. Honey-tubes very short, length less than the diameter; tip of the abdomen extending or drawn out to a point, but no true tail was observed. Along the lateral margins of the abdomen, in front of and behind the honey-tubes are minute tubercles, each giving rise to a hair; these tubercles are quite distinct, and about one to each segment.

Prof. Bundy furnishes the following brief note in reference to this species:

"On elm (*Ulmus Americana*). June, Sauk City, Wisconsin; scattered. Female uniform lemon-yellow."

I am in considerable doubt in reference to the proper generic position of this species. It evidently belongs to *Callipterus*, as defined by Koch, but Passerini has cut off from this his genus *Pterocallis*. I have but one memoir of the latter author, and although this contains a conspectus of the genera, it does not contain a diagnosis of this genus.

So far as I can ascertain this species is evidently quite distinct from any other species described as from the elm.

CALLIPTERUS QUERCIFOLII. N. Sp.

Winged specimen.—Antennæ nearly as long as the body, seven jointed; first joint quite large and very prominent, nearly twice the length and twice the diameter of the second joint, which is rather small, and of the usual sub-orbicular form; the third joint longest, but it exceeds the 4th very little, 5th very little shorter than the 4th; sixth not more than one third the length of the fifth; seventh a little shorter than the sixth.

The wings as usual; third discoidal vein of the front pair twice forked; the hind pair with two discoidal or branch veins; all the veins and branches are bordered with dark brown, giving them the appearance, when seen through a pocket magnifier of broad black veins; the bordering does not expaned at the tips of the veins, but retains its uniform width throughout. Stigma opaque, brown, with a posterior bordering of brown, fusiform in shape, being very acutely pointed at the apex, with no internal angle at the point where the fourth vein arises.

Costal vein very distinct, and rather prominent, it and the sub-costal vein are remarkably parallel, the distance apart scarcely varying even to the smallest degree from the base to the stigma. Distance between the insertion of the first and second, and second and third veins about equal; the second fork about equally distant from the apex and first fork. Fourth vein nearly straight at its base, curving regularly but not sharply towards its apex, runs very nearly with the first fork of the third vein.

The front of the mesothorax distinctly broader than the prothorax, the offset forming a distinct shoulder. The abdomen terminating suddenly and bluntly; no tail apparent. Honey-tubes very short and thick, slightly enlarged at the base, the length greater than but not twice the diameter.

When seen through a pocket lens, these (alcoholic) specimens appear dark brown; the antennæ annulated alternately with dark brown, or fuscous and white; the legs brownish or dusky with the base of the femora and tips of the tibiæ pale; the wings transparent with the broad dark-brown or fuscous veins previously described. The body dark-brown except the tip of the abdomen, which is pale and shows traces of transverse dark bands.

Wingless specimen.—Somewhat regularly ovate but sub-truncate at the posterior extremity, or at least rounded very bluntly and suddenly to the tip. Antennæ not quite as long as the body showing the light and dark annulations very distinctly. Eyes of this as well as the winged specimens reddish-brown. The ground color of the body of the alcoholic specimens, is pale dirty yellow, but the dorsal surface is chiefly occupied by broad transverse brown or fuscous bands which extend to the somewhat broad depressed portion of the lateral margins; there is one band on each segment; a pale line runs along the middle of the back from the head to the tail. Legs as in the winged specimens. Scattered over the body are stiff spine-like, black hairs; it is also more or less covered with small tubercles. Honey-tubes as in the winged specimens, pale yellow.

Length of winged specimen to the tip of the abdomen (which is somewhat shrunken) .06 inches; to tip of the wings .15 inches.

Prof. Bundy, of Sauk City, Wisconsin, from whom the specimens were received, makes the following statement in reference to them: "Abdomen of the female light green below, black above with four greenish spots; honey-tubes and tip of the abdomen white, head and thorax black, shining above. Eyes black; antennæ light, banded with black; wings with widened veins and tinged with purple (reflection.)" "On Red Oak (*Quercus rubra*) leaves, in June, Sauk City, Wisconsin. On both sides of the leaves along the veins. Leaves becoming viscid from their secretions."

This is evidently distinct from the *Callipterus quercus* of Kaltenbach, which is of a pale ochre color throughout, and nearly smooth, and has the veins of the wings unmargined. It approaches somewhat closely to the *C. juglandis* Frisch, which is found on Walnut. In that species the markings of the abdomen are almost exactly as in this, but the abdomen is much more drawn out and tapering than in this; but it is more than probable that the shrinkage caused by the alcohol has caused this to present the blunt appearance.

CALLIPTERUS CASTANEÆ. Fitch. The Chestnut Gay-louse.

On the under sides of the leaves of the chestnut tree, puncturing them and sucking their juices in August and September; a small, sulphur-yellow plant louse, with black shanks and feet, its antennæ also black except at their bases and as long as the body, its wings pellucid, their first and second oblique veins and the tip of the rib vein edged with coal-black, and its thighs straw-yellow. Length 0.09, to tip of the wings 0.15.

This insect, in company with wingless larvæ and pupæ of the same color, may frequently be met with upon the under sides of chestnut leaves. The name, "gay-louse," which is of the same import with the generic term, *Callipterus*, and is the equivalent of the German name, *Zierlaus*, which Koch applies to these plant lice, will be the most appropriate designation which our language furnishes for this and other species of this genus. Their bright, lively colors, and their long, slender antennæ and legs, render them the prettiest objects belonging to the Aphis family. (Fitch.)

SECTION LACHNINI.

This secion, as heretofore stated, corresponds, as usually given, with the sub-family *Lachninæ* of Passerini. As here given it differs in having *Callipterus* removed from it.

It is distinguished from the *Siphonophorini* and *Aphidini* by the following characters: The antennæ are but six-jointed, the sixth sometimes being furnished with a short spur which might be considered as a rudimentary seventh; the honey-tubes are reduced to simple tubercles or are obsolete. The antennæ are not situated on tubercles. Like the previous tribes or sections, the species belonging to this have three discoidal veins in the front wings, the third twice forked; the the hind wings two discoidal veins. So far as known, all the species produce winged individuals at some time; and are oviparous and viviparous as in the preceding sections.

They are found generally on trees or woody plants and mostly on the limbs and leaves. All or nearly all of our species so far as investigated are found on trees.

None of the species have, so far as I am aware, ever been found doing any considerable injury to useful or ornamental trees in this country.

The section is a limited one as at present restricted, containing but two or three represented genera, and but few species.

Genus LACHNUS. Illiger.

This genus is closely related to the preceding one; as in it, the front wings have the third discoidal vein twice forked, but the stigma is more of a linear shape, being longer and narrower; and the fourth, or stigmatic vein nearly straight or but slightly curved; the posterior wings have two branch veins. The antennæ are usually short, extending but little beyond, and often not to, the middle of the body, but slightly tapering; the sixth joint is usually or perhaps always furnished with a little spur at the tip, which is shorter than the sixth joint and often minute. The head is small and the prothorax narrow; the abdomen is rather more than usually broad, especially posteriorly. The beak long and rather slender, extending to, and even beyond, the posterior coxæ. The honey-tubes are reduced to mere tubercles, and sometimes almost obsolete. The colors are generally somber, dull red, brown and black prevailing. Dr. LeBaron was of the opinion that, as a rule, the abdomen is marked by transverse rows of dots; but there are too many exceptions to consider this a rule.

Although often found on the branches of trees, they are by no means confined to these, as they frequently occur on the leaves; but as a very general rule they reside on trees.

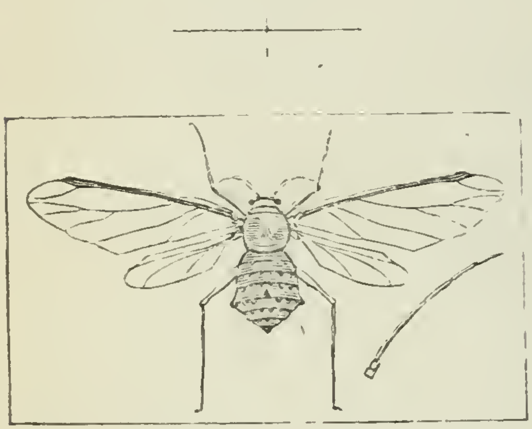
Lachnus salicicola, Uhler. The Plant-louse of the Willow.

This is the *A. salicti* of Harris, but as this specific name had already been given by Schrank to a European species infesting the willow, Uhler changed it to the name we have here given. It is evidently very closely allied to the following, yet appears to be distinct. It is a large species, although smaller than *L. dentatus*, and lives on the branches and twigs of various kinds of willows, clustering together on the under side, often in great numbers. The winged individuals appear about the first of October. The body measures about one-fourth of an inch in length; to the tips of the wings about two-tenths. They are without the conical projection, or stylet, found in most of the species already described, at the tip of the abdomen; the honey-tubes are much shortened. The body is black, and the abdomen is without dots which are so often present in this genus. The wings are pellucid, but the veins are yellowish, as are the legs, the honey-tubes and the first joint of the antennæ. As in the following species, when crushed it gives out a stain of reddish or deep orange color, showing such a strong resemblance to that species in this respect, as well as in its habits, that were it not for the marked differences in coloration and size we should not hesitate to consider them as but varieties of one species, which further evidences may yet prove to be the case.

Lachnus dentatus, LB. (Fig. 18). The Spotted Willow. Aphis.

As Dr. Le Baron----who first named this species----has already described it in his Second Report, it will be unnecessary for me to do more than simply mention some of the chief characters as there given, as I have nothing to add to what he has said.

Fig. 18.



It is found in October and November, in colonies, on the under side of the branches of the gray willow; and occasionally, but apparently accidentally, on trunks of small nursery apple trees. The winged individuals measure about one-sixth of an inch to the tip of the abdomen; the wings expanding about half an inch. Black; abdomen dark and ash color, with six transverse rows of black dots. Antennæ as long as the head and thorax. Front wings with a very long stigma; the third vein withtwo forks, as usual in this genus. Honey-tubes reduced to mere tubercles. Thighs dark honey-yellow, broadly tipped with black; tibiæ dusky reddish at the base. The dots on the abdomen are very distinct in the full grown individuals, the intermediate rows have six dots in a row. Just behind the middle of the abdomen and occupying the place of the two middle dots in the fourth row, is usually a somewhat conspicuous, black, conical protuberance. When crushed they stain the fingers red.

The cross at the top of the figure represents the natural size of the insect when the wings are opened; the bent line to the right is a crude representation of an antennæ enlarged.

Lachnus caryæ. Harr. The Hickory Plant-louse.

This is the *Aphis caryæ* of Harris, and is found on the pig-nut hickory (*Carya porcina*), clustered on the underside of ,the limbs in summer. It is perhaps our largest species, measuring one-fourth of an inch to the tip of the abdomen, and above four-tenths to the tips of wings. The honey-tubes are quite short, and there is no stylet at the end of the abdomen. The body appears to be slightly powdered or pruinose; the abdomen is marked with four transverse rows of black dots; the upper side of the thorax and the veins of the wings are black, as are also the tibiæ and tarsi; the thighs are reddish brown; the antennæ are dark and clothed with black hairs.

LACHNUS STROBI. Fitch. The White-pine Lachnus.

Found in colonies on the ends of the branches of the white pine, and probably also on other pines, puncturing them and extracting their juices; giving to the bark on which they are located, a peculiar black appearance. The winged individuals measure two-tenths of an inch to the tips of the wings; they are black, hairy and sometimes dusted over with a white powder, with a row of white spots along the middle of the abdomen; the thighs are pale yellowish at the base; the fore wings hyaline, with black veins, the third being exceedingly slender. The wingless individuals are about one-eighth of an inch long, brownish black, with a white line along the middle of the thorax, and white spots along each side of the abdomen, but the latter are sometimes very dim, or wanting; antennæ pale, with tips black. Dr. Fitch says it is a very common thing to find winged individuals with the third vein of the fore wing but once forked, showing the very close relation of this species to the wooly plant-lice (*Schiz meura*). It is possible that this may yet prove to be identical with the *Lachnus pini* of Europe.

LACHNUS LARICIFEX. Fitch. The Tamarack Aphis.

This species is usually found solitary on the small twigs of the American larch (*Tamarack*), stationed chiefly in the axils of the tufts of leaves. The wingless individuals, which are the only ones as yet described, are of a brownish color, often with a slight coppery tinge; length about one eight of an inch; with a dull white line along the middle of the back, and a similar whitish band at the sutures of each of the abdominal segments; in these bands there are three black punctures on each side of the middle; the short tubercular honey-tubes deep black; the under side dull white and dusted with white powder; the legs pale, with the feet and knees black. According to Dr. Fitch, from whose report the above description is taken, many of these insects were noticed on a particular tree, in May, but no winged ones among them. Many of them were accompanied by four or more young, huddled close around the base of the sheath from which the leaves arise. These were dull yellow with two brown spots on the abdomen, near the base.

LACHNUS ABIETIS. Fitch. The Spruce-tree Lachnus.

Occurs on the *Abies nigra*. The wingless females are pubescent, broadly oval, blackish, clouded with brown, with a faint ashy stripe on the back; under side mealy, with a black spot near the tip; antennæ dull white, with a black ring at the tip of each joint. Length to the tip of the abdomen, 0.15 inch. Whether this is the *L. abietis* of Walker or not, I am not at present able to state.

LACHNUS ALNIFOLIÆ. Fitch. The Alder-leaf Lachnus.

Found on alder leaves. Green; antennæ greenish-white, with four black rings; legs greenish white; feet, knees and a line on the posterior side of the tibiæ, black; wings hyaline, the discoidal veins black. Length, 0.10 inch.

LACHNUS QUERCIFOLIÆ. Fitch. The Oak-leaf Lachnus.

Dr. Fitch describes this species as follows:

"Light yellow; antennæ pellucid white, with a slender black annulus at the tip of each joint; fore wings with a blackish spot on the apex of each nerve, and a deep black dot on the base of the curved apical nerve; stigma whitish. Length to the tip of the wings .15. On the leaves of the white oak. Male (?)."

The following is a description of a species I found on white oak leaves, which I presume is the same that Dr. Fitch describes:

Apterous individuals.—(apparently hardly full-grown).

Antennæ longer than the body; third joint longest, the second about four-fifths the length of the third, thence decreasing regularly to the sixth, which is divided into two parts differing in diameter, or there is a seventh which is not more than half of the length of the sixth; sparsely covered with hairs placed alternately. Honey-tubes very short, the diameter exceeding the length, snowy white; tail short, semi-circular; body slightly hairy. General color brown; head paler and yellowish; first two pairs of legs transparent white; hind legs brown, except the tarsi, which are pale. Beak whitish, and reaching slightly beyond the third coxæ. The young are yellowish white, with brown patches; as they increase in age they grow darker, assuming a tortoise-shell appearance; the middle of the back and a spot each side of the abdomen at the shoulders, pale. The older specimens show a distinct ridge along each side of the abdomen. Segments of the abdomen very distinctly marked. Nearly oval in form; length less than one-tenth of an inch.

Found on the upper surface of the leaves of the white oak, at Carbondale, Illinois, in August.

If this is the same as Dr. Fitch's species, I have some doubt as to the correctness of the generic position he has assigned it; but am unable to determine positively until I can obtain winged specimens; if these should have clouded wings I would place it in *Callipterus*. They were partially covered by fine particles of matter apparently cemented by a viscous fluid.

LACHNUS SALICELIS. Fitch.

Under this name, Dr. Fitch gives a brief description of a species found on the willow which he supposes is different from either of those described as found on this tree. It is smaller than the one first described by Dr. Harris *L. salicicola,* and like that species is without the transverse rows of dots on the abdomen; and I rather suspect that after all it is but a variety of that species.

It is black; tibiæ and base of the antennæ pale; base and costal margin of the forewings yellowish-white. Length .08 inch. Resides on the succulent twigs.

LACHNUS ULMI. Linn.

In my paper on Plant-lice published in the 10th vol. of the Transactions of the Illinois State Horticultural Society, I mentioned a species by this name, following Dr. Fitch. This was an error, the species described by Linnaeus as *Aphis ulmi* is now *Schizoneura ulmi* hereafter described. The *Aphis ulmi* Deg. is now *Tetraneura ulmi.*

LACHNUS POPULI. Linn.

In the same paper I noted a species by this name, also following Dr. Fitch. This is now *Chaitophorus populi* and is distinct from our species, which I have named *Chaitophorus populicola.*

LACHNUS LONGISTIGMA. Monell.

"General color dusky, abdomen cinereous, with four rows of black dots. Apex of the stigma extending to the stigmal vein. Third joint of the antennæ as long as the two following taken together, sixth joint about half as long as the penultimate.

Length of the body 0.17—.20 inch; to tip of wings 0.33—.35 inch.

"The antennæ, body and legs are very hairy. Head and thorax black. Abdomen ash gray, but appearing dusky on being divested of the pruinose matter; dorsal surface with four rows of black spots, which, on close inspection with a lense, appear to be slightly elevated above the surface. Wings somewhat fumose; the "insertions" red. The veins are as usual in this genus, the first two discoidals being very much more robust than the cubitus. Stigma black, linear, extending along the apical margin of the wing to the apex of the stigmal vein, which is short and quite straight. The stigma is often slightly yellowish towards the tip and, in normal specimens, seems to extend just to the apex of the fourth vein, but frequently they are about .005 in. apart; and in one abnormal specimen the stigma extended nearly .01 beyond the stigmal vein. In some specimens the intercostal cell is not perceptible. the costal and snb costal veins appearing as if connate, while in others the exterior basal angle of the stigma is not so far back as the base of the cubitus. The distance between the apex of the upper furcal andthat of the stigmal vein, is equal to about one-third of the distance between the tips of the furcals.

Since the above was written, I have found this *Lachnus* living in great abundance on the underside of the branches of Linden, a few miles west of St. Louis. The apterous specimens do not differ in coloration from the winged ones. The newly born larvæl have the head, thorax and legs yellowish and the abdomen greenish." (Monell.)

GENUS PHYLLAPHIS. Koch.

This genus is very similiar to *Lachnus*. The third discoidal vein of the front wings is twice forked; the fourth, or stigmatic vein, is slightly curved but not so distinctly as in *Callipterus*; the stigma is trapezoidal, but narrow, approaching *Lachnus*in this respect. The antennæ short, scarcely extending beyond the end of the thorax; spur of the sixth joint sub-obsolate. Body broad behind and wooly. Only one species has been placed in this genus, the *Aphis fagi* of Linnaeus, which is found on the beech.

PHYLLAPHIS FAGI. The Beech Aphis.

The winged female is of a bright green color; thorax dark green; abdomen with alternating, dark and light green, transverse stripes; eyes red; legs dull yellow; head and prothorax yellow; abdomen yellowish with interrupted, greenish, transverse stripes; antennæ and legs yellowish. (From Koch's figure.)

GENUS SIPHA. Pass.

This genus resembles *Aphis* so closely that it is unnecessary to mention any characters, except the one in which it differs from that genus. the antennæ are usually quite short extending but little beyond the end of the thorax; they are but six jointed, and in our species are similar in form to those of *Aphis.*

SIPHA RUBIFOLII. New sp.

This species found on the leaves of the blackberry, bears a close resemblance to the *Aphis mali* in color, size and habits, but there is one marked difference which would seem even to forbid its generic association with that species.

Winged female.—Head and thorax black; abdomen green; wings with dark veins, and when seen together above the back, in the living insect, presenting a slightly smoky appearance. The fourth or stigmatic vein regularly curved; stigma elongate, pointed, usually slightly dusky; the second fork of the third vein about equally distant from apex and third vein, in the wing on the one side, while it is much nearer the apex in the wing on the other side, of the only specimen where this character is observed. (Other winged specimens were examined, but no attention was paid to this character until after they were mounted, when it was found only one winged specimen had been preserved. Particular care was not taken of them, as I felt confident from my examination at the time, which was somewhat hasty, that they were identical with *A. mali*). Costal and sub-costal veins pale on their basal half. Abdomen pale green, with the margin and a line, darker green. Honey-tubes short, cylindrical, not reaching to the tip of the abdomen (base of the tail), pale, transparent green. Tail short, conical, rather obtuse.

Antennæ of all examined, winged and wingless, at the time they were found and those preserved, are but six jointed under the strongest magnifying power I have at hand; not quite as long as the body; first and second joints short and thick as usual in Aphis; third joint longest, exceeding in length fourth and fifth joints combined; fourth about half the length of the third, and a little longer than the fifth; sixth or apical joint setaceous and of the same form as in those with seven joints, shorter than the third, but longer than the fourth. The fifth is the usual form of the sixth, but rather longer in proportion; the third is longer than usual but no constriction, or amalgamation of, two joints, can be seen in any specimen examined; usually fuscous but not black, pale at base. Legs pale, tarsi fuscous.

Wingless.—Body oval shaped; abdomen pale green, a darker green transverse stripe at the base, with usually five wavy lines of the same color, running from it toward the tip, occasionally there are dark green spots; head, legs and antennæ pale, with a yellowish tinge; tarsi and knees dusky. Antennæ short, not reaching to or beyond the honey-tubes; honey-tubes short, as in the winged.

Found on the underside of the leaves of the common blackberry, usually along the mid rib or one of the larger lateral veins, causing the leaf to curl downwards. When near or along a branch vein, the curling is very irregular, contorting the leaf.

To all appearance, save the antennal character, this seems to be a true Aphis, but this, according to present classification, would exclude it from this genus. It is possible it belongs to Passerini's genus *Sipha* in which I have placed it provisionally; but I am inclined to believe it a true *Aphis*, notwithstanding the remarkable variation in the antennæ.

SIPHA MAYDIS. Pass. The Corn or Maize Sipha.

I am not aware that this species is to be found in the United States; but as it is observed to infest our great staple, Indian corn, in Italy, it is possible that it may also infest it in the southern states.

Wingless viviparous female. Ovate convex; above dusky and pale, and pilose; below dusky and red and smooth; antennæ a little longer than the thorax, yellowish, fuscous at the base and apex. Legs dull yellowish; tarsi dusky.

Winged viviparous female. White and black above; fuscous beneath; wings opaque white, veins white.

Occurs on the underside of the leaves of maize or Indian corn, and some other plants as sorghum, etc.

SUB-FAMILY PEMPHIGINÆ.

This sub-family differs from the preceding one in several important respects, both as to character and habits. It also contains within it several sub groups or sections, differing from each other as widely as do the divisions of the sub-family already considered, in fact each genus given in the preceding synoptical table forms a distinct section.

Buckton, relying upon the wing characters as his guide in dividing the family, has separated this group into two sub-families; but I have preferred to follow, in the main, Passerini's arrangement, modifying it by the introduction of a genus he has placed elsewhere, which necessitates the modification of the characters he has given.

The characters of the group as now given will be as follows: Front wings with three discoidal veins; the third in some genera once forked, in others simple: the hind wings in some genera with two branch veins, in others with but one. As a very general rule the wings are erect in repose, but in a few species they rest horizontally on the abdomen. Some of the gall inhabiting species, when first taken ont of their place of confinement, have the wings apparently horizonatal or nearly so, but they soon assume the normal, erect position, if the insects are allowed free exercise in the open air. I have observed this habit in the species that inhabits the cockscomb gall of the elm. The antennæ are usually six-jointed, but in one genus which I have introduced into this sub-family, they are but five-jointed. Serville and Amyot (*Hist*, *de Hemip.*), or the authors they follow, have made a singular mistake in reference to the number of joints in these insects, in giving the characters of their *Myzoxylides*. which inclndes the subfamily now under consideration. They state that these organs contain but five joints, the *second* being the longest. It is evident they overlooked one of the two small basal joints. The third joint is the longest, as is the general and almost universal rule throughout the family. These organs are short, seldom reaching beyond the middle of the body, and often extending no farther than the middle of the thorax.

Some of the species reside upon the bark of the trunk and branches of trees, others on the leaves of various plants; some have the habit of covering themselves with a cottony secretion, while others, by a singular provision of nature formd, galls in which they reside.

This white, cottony substance is secreted by certain glandular organs in the abdomen and thorax, with which the species that produce it areprovided. Its production is not confined to thisfamily, the Beechaphis of the preceding family producing it in threads as long as its body; nor is it an uncommon occurrence among the *Chermesinæ*.

This substance, which bears some analogy to silk, if examined by a high magnifying power, will be found to consist of long, flattened threads or fibres, which when broken across present sharp fractures as if they were brittle, and, according to Buckton, from whose work this statement is taken, they present obscure transverse and longitudinal striations.

The same author states that this material is insoluble in water, alcohol and solution of potash; that it scorches brown over the lamp without melting; and gives off at the same time a nitrogenous odor like burnt feathers. He concludes therefore that it is a different substance from the waxy secretion of many other Homopterous insects.

That the substance resembling cotton found covering such species as the Wooly Aphis of the Apple-tree is not of a waxy nature, and is insoluble in water and alcohol I know to be true by experiment, and that it will not dissolve like wax by heat I also am aware is true. But that some species at least of *Pemphigus* do secrete a waxy substance that will dissolve on being submitted to the heat of the hand I think is also true. In one instance at least I have observed this to be the case. But in this instance the secretion took that peculiar form seen in other Homopterous insects of which Mr. Bucton speaks. I am also inclined to think the same thing is true in reference to one at least of the species infesting pine leaves and twigs.

In some cases this secretion, instead of being lengthened out into fibres, assumes the character of down or fine powder, like meal. This substance, at least when it is in the form of meal, protects the Aphides from water which would otherwise prove destructive where they are in confined positions and subject to its action, as in Galls and subterranean situations. The value of this mealy secretion to these insects can readily be tested by putting a small drop of water into the midst of a colony of the Elm-leaf Aphis (*Schizoneura ulmi*); or it may be seen in some of the larger galls made by Pemphigi, where small drops of fluid may be seen rolling about, apparently without in the least discommoding the inhabitants.

The little shining, colorless, spherical bodies which can be seen rolling about among the colonies of the Elm-leaf Aphis, when we handle the curled and distorted leaves, according to Buckton, consist of fæcal matter discharged from the anal aperture. They are sometimes taken by mistake for eggs.

As is well known to all who have studied with any degree of care the habits of insects, galls are produced by species of several different orders, and that, as a rule, each species forms a gall of a peculiar shape. Although not confined wholly to this sub-family yet it is here we find the gall-making habit chiefly developed; and in fact confined mostly to the species of the true *Pemphigini* included in section two as below explained. What particular agency is employed and how developed to form these galls is yet an unsolved mystery. Blot says, the female inserts an egg under the surface of the young leaf in the tissue and that the gall grows up around it, or to use his words, "is born upon the surface." But the peculiar character of the gall does not appear to agree with this statement. Instead of being true, closed galls they are, in fact, abrupt, purse-like foldings of the entire thickness of the leaf-blade, leaving a narrow opening on the side opposite to the gall for the escape of the insects, which having no means of eating their way out, would otherwise be hopelessly confined in a prison of their own building; the galls formed by mites are similarly constructed. In reference to the method of passing the winter, it appears to be generally conceded by entomologists that, as a rule, it is in the egg state. I have some reason to question this conclusion if it is to be applied to all the species. My reason for this doubt will be given when I come to describe the Wooly-Aphis of the Apple-tree (*Schizoneura lanigera*). I am inclined to believe some if not all, the species of this sub-family will approach more nearly to Phylloxera in their mode of reproduction and of passing the winter than to the true *Aphidini.*

As a general rule the species are ærial, that is, they reside exclusively above ground, but one or two at least and in all probability some others of the trunk-inhabiting species, penetrate to the roots and become subterranean; whether these can be considered as true dimorphic forms has not as yet been satisfactorily determined.

This sub-family, as above indicated, may properly be divided into two or three different sections. The following arrangement appears to me to be the most natural.

A. Third discoidal vein of the front wings twice forked.
  a. Antennæ six-jointed. Sec. 1. *Schizoneurini.*
  aa. Antennæ five-jointed. Sec. 2. *Vacunini.*

AA. Third discoidal vein of the front wings simple; antennæ six-jointed. Sec. 3, *Pemphigini.*

SECTION 1. SCHIZONEURINI.

This section corresponds with Buckton's sub-family *Schizoneurinæ*, and is distinguished by the following characters: Third discoidal vein once forked; antennæ six-jointed. In a complete synopsis of all the known species it might be useful to divide the section into two sub-sections based upon the number of branch veins in the hind wings; but this is unnecessary here, as I have included all of our species of which I have any knowledge under two genera, each representing one of these sub-sections.

GENUS SCHIZONEURA.

The characters of this genus are partly given above in describing the section. In addition to what is stated there may be added the following characteristics: Posterior wings with two branch veins, which usually originate close to each other, sometimes in contact. The three branch veins of the front wings, and especially the first and second, approximate at the base or point of junction with the sub-costal vein; the third is often obsolete at the base. The antennæ are short, those of the winged individuals seldom extending beyond the end of the thorax; while those of the apterous individuals usually reach only to the end of the prothorax; the third joint is longest. There are no visible honey-tubes. The body is usually rather broad, elliptical in the winged and broadly ovate in the apterous individuals. The colors are usually black, brown or reddish. The beak rather long and slender.

This is pre-eminently the wooly genus of the sub-family, and contains one of our most injurious species, the Wooly Aphis of the apple tree.

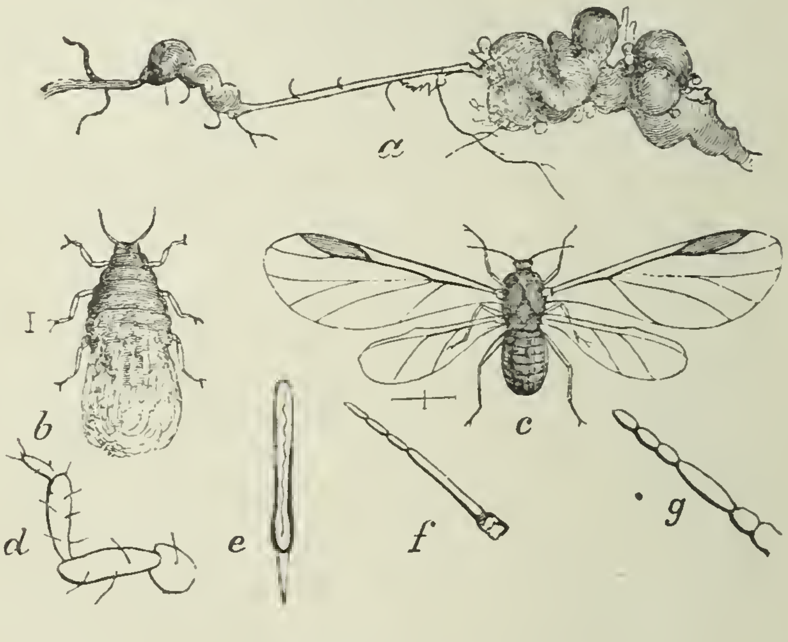
SCHIZONEURA LANIGERA. Hausm. The Wooly Aphis of the Apple-tree.

Syn. *Aphis lanigera.* Hausm.
Coccus mali. Bingley.
Eriosoma mali; (Leach mss.) Samouelle.
Myzoxylus mali. Blot.
Schizoneura lanigera. Hartig.
Pemphigus pyri. Fitch.
Aphis (*Schizoneura*) *lanigera.* Ratz.
Eriosoma lanigera, Ruricola.

I copy the following article on this species from a previous report I made on injurious insects, to the Illinois State Horticultural Society, adding at the close such new facts as I have since ascertained in reference to it.

"The *Sch. lanigera*, or Wooly Aphis of the Apple-tree, was first described and scientifically named by Hausmann in 1801, as infesting the apple-trees of Germany. According to Serville and Amyot, it was unknown in Europe until 1787, at which time it was first seen in England, having been imported that year from North America. Tougard (*Ann. Soc. d'Hort. de Paris*) asserts that it was unknown in Belgium previous to 1829. The same authors also assert that it was unknown in France previous to 1812. Harris, relying upon the authority of Sailsbury, ("Hints on Orchards,") asserts that it was known to French gardners for a long time previous to the earliest of these dates

Fig. 19.



Apple-root Plant-louse.

A. Part of a root infested by the Apple-root Plant-louse. *B.* The larva with the usual wooly matter attached to its back. *C.* The winged insect with the wooly matter all removed. *D.* Leg of the perfect insect. *E.* The beak. *F.* Antennæ of the winged insect. *G.* The antennæ of the larva.

If it was imported from America to England in 1787, it did not pass into France until 1812, and did not reach Belgium until 1829, although possible, yet it is somewhat strange that Hausmann should describe it as infesting apple-trees in Germany in 1801, and that without any hint of its recent importation. A careful examination of what is said by Serville and Amyotd in reference to this point, indicates that they overlooked Hausmann's statement, yet they used his specific name and had before them volume 1, of *Illiger's Magazine*, in which the description is found and statement made. These facts, when connected with Salisbury's statement, give us reason to doubt the correctness of the assertion that it was imported into England from America. I may also further add, that M. Eudes Deslongchamps, in a prize essay to the Royal Agl. Soc. of Caen in 1830, and M. Blot, in a work of the same date, maintained that it was not introduced from North America, but that it was indigenous to Europe, that occasionally, under favorable circumstances, it was greatly multiplied in certain localities, and then for a time would disappear, and hence the idea of its importation. The name "American Blight," given to it in England, indicates, on the hand, the popular belief in that conntry, of its American origin.

Prof. Riley in his third report (1871,) asserts, upon what authority I am unable to say, that it is conceded on almost all sides that it was imported into Europe from America, and that there is every reason now to believe the two species here mentioned are indentical, or at least but varities of one species. Whithout attempting now to decide this point, as I have no European specimens, and am without copies of some of the latest works on the subject, I will give brief descriptions of the former species—the Wooly Aphis (*Sch lanigera*)—as found in Europe, and what is supposed to be the same species found in this country.

The most recent description I have at hand at this moment is by Goureau (1862), who gives the characters briefly as follows:

Apterous individuals.—About one-tenth of an inch long; reddish brown and covered above with a white, cottony secretion; antennæ short, and pale yellow; legs yellowish; knees brown; without honey-tubes, but with a circular cicatrix in place of each.

Winged individuals.—Antennæ shorter than the head and throax, and varying in color from brown to black; head and throax black, a brownish ring at the collar; the abdomen chocolate brown; legs, brownish; wings, hyaline with the veins and stigma deep brown; body enveloped in a white, cottony secretion. Serville and Amyot give the length of the apterous individuals as only eight hundredths of an inch; they described the winged individuals as less and with the body almost naked.

1. Hausman and Knapp, and Harris, following them, were of the opinion the species never acquired wings; but so far as the European type is concerned, this is evidently a mistake; and Mr. Verrill, in an article in *The Practical Entomologist*, informs us that he has observed quite a number of winged individuals of this species—both males and females—upon apple trees in New England. These he describes as having well-formed and rather large wings, but in other respects closely resembling the apterous specimens, except that they had but little of the downy substance on their bodies, which were nearly black

and rather plump. The fore wings were large, and had three discal (branch) veins, the third one forked near the middle, and scarcely visible near its base before forking. The stigma, or colored spot, was about three times as long as broad, and acute at each end. The hind wings were about half as long as the others, and quite narrow, with two simple discal veins.

Let us now turn to the other species, the Apple-root louse (*Pemphigus pyri*), and examine briefly its history and habits, and what relation it has to the other speciest that has induced me to speak of the two together.

This species was originally described by Dr. Fitch, in 1851, as *Eriosoma pyri*, (1855) transferred by him to Pemphigus, because the third vein of the fore wings of his specimens were simple, and not forked. Mr. Walsh in volumo 1, of the Proceedings of the Entomological Society of Philadelphia and in *The Practical Entomologist* (1866), declared the two species to be distinct. In the latter, he states, in answer to a correspondent from Pennsylvania: "You think that the *Aphis* that causes warts or knots on the roots of young apple trees in the nursery is the same insect on the *Wooly Aphis* that lives on the twigs. You are, undoubtedly mistaken, for they do not even belong to the same genus, much less to the same species. The Wooly Aphis is *Eriosoma lanigera*, the Apple root Aphis is *Pemphigus pyri*."

In his first report, as acting State Entomologist (1868), he repeats this declaration emphatically, and proceeds, not only to give the differences between the characters of the two species, but also of their habits; contending, after Blot, that the former is exclusively northern, while the latter is more southern. He also states in reference to the wooly Aphis: "It is now, however, pretty clearly ascertained to have existed on the continent of Europe from time immemorial, and it probably emigrated thence to England on imported apple trees." It is proper to add, that up to this time Mr. Walsh had not succeeded in obtaining any winged individuals of the apple root Aphis, but had relied implicitly on Dr. Fitch's description. Not only is it much less, but does not even belong to the same genus, being a true species of *Eriosoma*, with the third vein of the fore wings forked. The authors, upon making this discovery, came to the very reasonable conclusion that Dr. Fitch was mistaken in believing his specimens belonged to the apple-root louse; that they must have been stray specimens which had in some way become intermixed with the specimens of the latter species. They also argue from the habitats of the two species (the root louse and Wooly Aphis), and from the fact that this works on the roots, while the *Sch. lanigera* works on the trunks and branches; that the American species is not identical with the European, and that the latter is unknown in the United States. This article was in great part transferred by Prof. Riley to his first annual report (1869), without any dissent to the views there expressed; but in his third report (1871), as heretofore stated, we find him expressing the opinion that the two species are identical, or at least but varieties of one species, and that the former (*Sch. lanigera*) was imported into Europe from this country, which opinion, I believe, he still entertains.

One or two more facts and suggestions, and for the present I will leave the matter with the reader, that he may form his own conclusions.

I have repeatedly seen in the southern part of the State winged individuals among the colonies of the wooly plant-lice on the trunks of apple trees; these I always regarded as belonging to the colonies. They correspond with the description given by the editors of the *Entomologist*, in regard to color, size and wings, but were found upon the trunks and limbs of the trees, and around the collar at the surface of the ground, and may, for aught I know, have been also on the roots, as I did not extend my examination to these. But it is certain they are quite common on the trunks and branches, in the little fissures, breaks and abraded spots in the bark. Goureau also states that the European species is found on the branches, trunks and roots of the trees. Verrill's description of the specimens he found in New England, agrees exactly with that of the apple root-lice found by the editors of the *Entomologist*. It appears, therefore to be pretty well settted, that Dr. Fitch was mistaken in reference to where his winged specimens belonged, or that his species differ from the apple-root louse of the West. It has also been pretty clearly demonstrated that the Wooly Aphis of the trunk and branches is the same as that found on the roots. On the other hand, the preponderance of evidence appears to be against the idea of importation from America to Europe.

Dr. Fitch's species may be briefly described as follows: The young larvæ are scarcely 0.04 of an inch long; of an oval form, and pale, dull yellow color. Legs short, robust, and nearly equal in length. The antennæ appear much like a fourth pair of legs, and apparently five-jointed. From the tip of the abdomen is usually seen protruding a white filament of flocculent, cotton-like matter. It is proper to state that in some respects this description differs slightly from the appearance of the larvæ I have examined from the trunk.

Winged individuals.—These are nearly a quarter of an inch long to the tips of the closed wings; body, legs and antennae, coal black; the head and abdomen covered on the back with cottony down. Front wings, transparent and slightly smoky, as though sprinkled with fine dust; veins, black; the third vein is rather more slender than the first, nearly straight, not forked, its basal third abortive; stigma dark, smoky brown, oblong; its opposite sides nearly parallel, abruptly converging to an acute point at each end. Hind wings, clearer; the two discoidal veins, black.

The winged individuals found in Illinois may be briefly described thus: General color, black; antennæ not quite half as long as the body, third joint half as long as the entire antennæ; abdomen, more or less sprinkled with white downy matter. Wings transparent; third discoidal vein forked near the middle, its basal portion obsolete; stigma nearly three times as long as it is wide, pointed at each end, and pale brown. Length to the tips of the closed wings, about one-seventh of an inch.

As it is certain that our Illinois insect infests both root and trunk, we may assume, so far as practical purposes are concerned, that the two supposed species (rejecting Fitch's winged specimens) are identical, and treat them as such.

These minute pests, having reached the roots in a way not yet fully and satisfactorily explained, by their numerous punctures and the extraction of the sap, cause irregular distortions, swellings and knots to be formed thereon. The effect of this, when the roots are badly infested, especially of young trees and nursery stock, is to cause them to become sickly and finally die. Where they are sufficiently numerous to cover and deform the root of a tree, the root almost invariably rots, then the lice leave it. As a matter of course, the effect produced by these insects on a young tree is much sooner perceived than on those that are older and larger. Prof. Riley found, from some observations made by him on an orchard at St. Louis, that young nursery trees, whose roots were badly infested, diedthe following season, the roots always rotting previous to the death of the tree. He appears also to think this rot can be distinguished from that produced by any other cause, by its being more porous and soft, and approximating the brown mould of a rotting log. Although there is a tendency in the deformities to disappear when the exciting cause is removed, yet where the lice only leave because it is dying, it appears scarcely possible that the deformities should entirely disappear, as the only means of removing them is gone when vitality is wanting; and these, if remaining, would indicate at once the cause of the rot. Most orchardist sare aware, that the work of these insects can generally be detected where they have been working about the collar of the trunk, even after they have disappeared; there is a peculiarity in the appearance of the bark, a roughened or shagreened appearance, it looking as though the thin delicate outer layer of bark or epidermis had been removed. If present, they may easily be recognized by the peculiar bluish white, cottony matter they secrete from their bodies, which is never met with in the case of the common Apple-tree Plant-louse (*Aphis mali*). The same thing is also true in reference to the spots on the trunk and branches which they attack. When they locate on these portions of the tree, they usually, and so far as my observations go, always select as a starting point, some fissure, cut, break or otherwise injured portion of the bark; or if these cannot be found, the wrinkles about the axils or forks of the larger limbs and elsewhere. I noticed some the past summer, in little scattered colonies, on the smaller limbs and even twigs of an apple-tree standing in my yard. If a tree is neglected and allowed to send up sprouts from the base of the trunk, the point where these join the trunk at or below the surface will be found a favorite resort for these insects.

Do they pass from the trunk and branches to the roots? Or, in other words what relation do the two races bear to each other?

Dr. Fitch thinks the parent insect insinuates hereself downward, along the side of the root, at the close of autumn, and there deposits her eggs and perishes; that these eggs hatch in the spring as soon as the ground becomes sufficiently warm, and that the colony is continued through the season by the viviparous propagation usual with the aphides; that in the autumn following, winged individuals again appear, and leaving the ground, seek new homes.

So far as the method of propagation is concerned, it has been shown by Dr. W. M. Smith, of New York, that it differs slightly from the true Aphides, in that the young larva produced by the agamic females are inclosed in the thin egg shaped covering heretofore mentioned, from which they have to free themselves in a manner analogous to hatching. The remains of this covering may often be seen attached to the tip of the abdomen, and is doubtless the supposed cottony secretion alluded to by Dr. Fitch, in his description of the young larvæ. The fact of acquiring wings is, in itself, an evidence that these individuals, are intended by nature to come to the open air with the power to roam and seek new localities. It is supposed by some that those on the trunk and branches remove to the roots as winter approaches. I have strong doubts on this point, unless by "removing," is meant that the mature winged females, which appear among these colonies at the approach of winter, after pairing, deposit their eggs on the roots. Mr. Verrill states, in *The Practical Entomologist*, that he found healthy and active lice, of all sizes, and busily engaged in sucking sap, on the under side of the branches, as late as December 11, after two snow storms and many cold rains and freezing nights. I have now, January 5, 1877, before me on the microscopic slide a larva of this species, just taken from the trunk of an apple tree, which is alive and struggling to escape; yet, as all are aware, we have just experienced one of the coldest spells of weather ever known in this section. It is proper to add that, although a part of the little colony from which this was taken, was living, the larger portion appeared to be dead.

I think it is evident the species may and perhaps often does, pass the entire round of the seasons, and undergo all its changes, on the trunk or branches, without any transfer to the roots. Yet the root may be, and probably is, its normal habitat, and the early winged females led by the mildness of the season to deposit their eggs on the trunks, the colony struggles on against the cold of winter with a remarkable vitality, which the species has acquired from its naturally cold habitat. So far as I am aware, no difference has been discovered between those dwelling on the trunk, and those on the roots, though this point has not been thoroughly studied.

Natural Enemies.—It is probable that the insects which attack the ordinary plant-lice will also attack with equal avidity the Wooly Aphis, especially those individuals found exposed on the trunk and branches; but as special enemies we may mention the following: A minute Chalcis fly (*Eriophilus mali*, Hald). has been described by Halderman as parasitic on the Wooly Aphis. A second insect enemy is the Root-louse Syrphus-fly (*Pipiza radicum*, W&R.,) first detected by Messrs. Walsh and Riley, as feeding on the larvae. The larva of this fly is a footless maggot, about half an inch long, and of a dirty yellow or pale flesh color; spindle-shaped, attenuated in front and somewhat more abruptly lessened behind; the body is marked with transverse ridges. When not extended, its length is only about one-fourth of an inch. A third enemy is a minute lady-bird, only about one-twentieth of an inch long, and of a deep brown color on the wing-

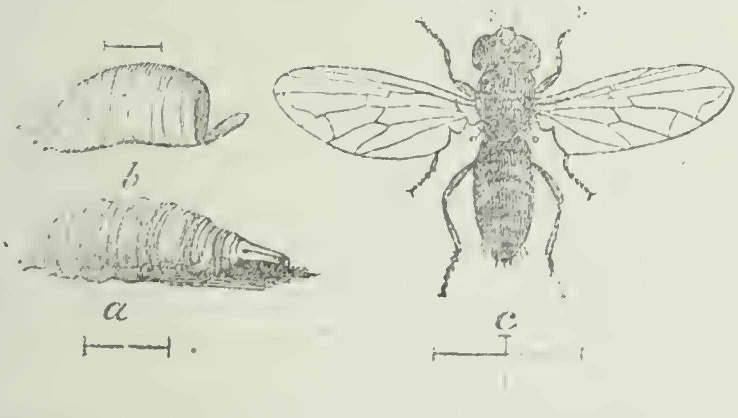


Fig. 20.—Root Louse Syrphus Fly. *a*, Larva, *b*, Pupa, *c*, Perfect Fly.

cases, the thorax being of a lighter color; its scientific name is *Scymnus cervicalis*, Muls. So far as observed, this species has only attacked those lice found on the trunks and branches or at the surface of the ground. I have also noticed a mite very often in the vicinity of the colonies, under circumstances which led me to believe it preyed upon these insects, but have not attempted, as yet, to determine the species.

Remedies.—When a tree ceases to grow with its usual vigor, its leaves becoming paler and more of a yellow hue than customary, and there is no apparent cause for this decline, it will then be well to examine the roots, and see whether or not they are infested by this louse. If found, some one of the following methods for destroying them may be adopted.

First, Dr. Fitch's, which is to clear away the earth from the roots as far as it can conveniently be done, and pour strong soap-suds upon them in sufficient quantity to penetrate and saturate the crevices in the excrescences. The soil taken out should be removed and other soil substituted, or, if returned to its place, ashes should be freely mingled with it. In the nursery, when transplanting or lifting the young trees, if a careful examination, which should always be made, shows any signs of the lice on the roots, they should be dipped in strong soap-suds, which will generally effectually destroy the lice.

Another method, which was long ago practiced by French horticulturists, and strongly recommended by Blot in his celebrated essay on this species, and which has also been recommended in this country by Harris, Walsh and Riley, is to drench the roots of the infested trees with hot water; applying a sufficient quantity to penetrate to all parts of the roots which are attacked. Riley remarks that mulching around the infested trees has been found, by Mr. A. E. Reihl and others, of Alton, to have the effect of bringing the root-lice to the surface of the ground, thus rendering them more easily reached by the water. That mulching or surrounding the collar with rubbish has a tendency to collect these insects at this point is certainly true, at least such appears to be the case so far as my observations have extended, but whether these are from the trunk or roots is a point I have not determined. It was on this account that I recommended mixing ashes or lime with the mulching immediately around the tree.

As to the lice on the trunk and branches, Harris mentions the following methods of destroying them:

Melted resin, mixed with an equal quantity of fish-oil, put on the infested spots, while warm, with a painters brush. Removing the old and rugged bark and scrubbing the trunk and branches with a stiff brush. Applications of spirits of tar, turpentine, urine, kerosene, soft soap, and other similar substances have been recommended.

The same author suggests the following method, which requires too much time and trouble, except now and then in a case of a very valuable tree: "Scrape off all the rough bark of the infested trees and make them perfectly clean and smooth early in the spring; then rub the trunk and limbs with a stiff brush wet with a solution of potash; after which remove the sods and earth around the bottom of the trunks, and with the scraper, brush and alkaline liquor, cleanse that part as far as the roots can be conveniently uncovered. The earth and sod should immediatly be carried away, fresh loam should be placed around the roots and all cracks and wounds should be filled with grafting cement or clay mortar. Small limbs and infested branches, beyond the reach of the applications, should be cut off and burned."

It is not very difficult to reach and destroy the lice upon the trunks and larger branches, as this can usually be accomplished by an application of strong lye, soap suds etc., put on with a whitewash brush; or what would perhaps be more effectual, kerosene mixed with some other kind of oil. The great difficulty is to reach the insects on the roots, and the failure of all such applications as those above mentioned to counteract the Grape Phylloxera would indicate, at least, a somewhat similar result in reference to the Apple-root louse, notwithstanding the confidence with which they have been recommended. The hot water remedy is probably the best yet suggested, as it is the simplest, and as effective as either of the others.

Blot was of the oppinion that topical applications were of comparitivly little value, his reliance being placed chiefly on preventive measures, and to this end he recommended the following culture: "Avoid giving to the nursery in which the young trees are, any more shade than absolutely necessary; avoid placing the trees in too flat or humid ground, give to both the nursery and orchard all ventilation possible, so that they may be thoroughly aired, and keep the heads of the trees open, so as to favor circulation of air and the drying of the soil; use the plow frequently, and do not permit rubbish or twigs to remain under the trees; surround each tree with a mixture of soot or tobacco and fine sand."

As a matter of course, the preventive measures by cultivation must depend in part upon the character of the soil. If a very sandy soil, the necessity for air and sunshine is not so great as where it is heavy, nor is there the same necessity for repeated plowings. I am of the opinion that in most of the heavy soils of our state, lime might be advantageously used in moderate quantities about the roots of the trees. And in the nursery, lime or ashes might aid in keeping off these insects. These applications, combined with clean culture, will undoubtedly aid very greatly in preventing the occurrence of this pest, and also others almost or quite as troublesome.

I have the following remarks to add to the foregoing article, partly to correct some implied rather than positive errors made therein; and to call attention to a generally received statement in reference to the species which I think needs further investigation before it can be received as conclusive.

I may repeat here my conviction, after a more thorough study of the species and an examination of authorities I did not have at hand at the time the foregoing article was written, that this species was brought to America from Europe, instead of being an American importation into Europe. The determination by Messrs. Walsh and Riley of the identity of the root and trunk species (*A. lanigera*, Hausm and *Pem. pyri*, Fitch) has a strong bearing on this question, and as it appears to me, should have as much and more weight in its decision than any other testimony we have. It shows that the apple is its proper and natural habitat or source of food, and as it is not replaced on the eastern continent by any other allied species, it is almost certain that it came with the apple from the native home of this plant. That it will live on our native crab may be true, but so far as my examinations have extended, it is rarely found upon them, and even prefers the sweeter kinds among the cultivated varieties, at least such appears to be the opinion of Dr. Fitch. Blot says it is confined to the apple, and if placed on any other tree will soon perish. He also adds further, that while it does not attack the flowers, fruit or leaves, but fixes itself upon the bark, *it will penetrate to the roots.* That the root and trunk forms are of the same species, appears to have been long known in Europe.

Its mode of spreading or migrating, and of hibernating have been given again and again by different writers, apparently without any doubt whatever as to the correctness of the statement. The most recent publication of this theory which I have seen, where it is likely to be read by agriculturists and horticulturists, is an article in a late number of the *Rural New-Yorker*, by Mr. B. Pickman Mann, of Cambridge, Mass. The writer gives the history and habits of the species correctly, as found in the books, omitting the discussion of disputed points, as importation, &c. Following out the idea advanced by Prof. Verrill, in an article published in the *Practical Entomologist*, (vol. 1, 1865), he states that the winged females appearing late in the fall, fly from tree to tree, deposit their eggs, which remain over the winter, and are hatched the following spring. Thus the mode of spreading, and the method of passing the winter are given in a single sentence; at least what is supposed to be the general rule. But it is proper to add that Prof. Verrill speaks of finding living specimens in December, and concludes that many of these insects pass the winter in the cracks and crevices of the bark, covered by their cottony secretions.

I allude to these statements not for the purpose of criticising them, but in order to present some reasons for doubting their correctness as to one or two points which are important, when we come to consider the best means of destroying them. I allude especially to the supposition that the oviparous female flies from tree to tree to deposit her eggs for the spring brood. As neither Prof. Verrill or Mr. Mann refer to personal observations on this point, I presume it is a theory based upon the known habit of some other species, as the *Aphis mali*, of depositing eggs in the fall to hibernate.

It is now pretty well ascertained, as stated in the introduction to this paper, that the oviparous female of the true Aphides (*Aphidinæ*) is always wingless, and that the winged female is viviparous. It is true that in the *Chermesinæ*, some of the species develope winged oviparous females, and I think it more than probable that the same thing occurs among the gall making species of the sub-family now under consideration, but there are strong reasons to doubt it in reference to the species of *Schizoneura*, whose habits are similar to those of the wooly aphis of the apple-tree. Koch states that the "Altmutter" (colony foundress) of two of the species of this genus are apterous; the Almtutter of one species he describes as winged, but it appears in the spring and is evidently viviparous. Analogy and the facts would therefore lead us to the conclusion that the winged female viviparous.

But there are additional reasons for doubting the correctness of the opinion advanced by Prof. Verrill on this point. One is the fact he states showing their power of enduring cold, which is confirmed by my own observations mentioned above. I have also to add that during the present winter (1878-9), while preparing this paper, I made an examination of some apple-trees this species was known to infest, as late as January, after one of the coldest spells we have experienced for a number of years. I found them on the trunk in little scattered colonies, in the breaks and injured spots, covered with an unusually heavy coating of cottony substance. Although apparently lifeless, most of them revived on being brought into a warm room. In each of these colonies were from one to five apparently mature individuals, the rest being larvæ; the former were all dead, the latter nearly all living. From these facts we might infer that these little colonies were formed in the latter part of summer, or in the fall, by wingless viviparous females, possibly the dead individuals observed. But, be this as it may, it is evident that they do hibernate otherwise than in the egg state, and so far we have no positive evidence that they pass the winter as eggs, unless the statement copied by Dr. Harris from Knapp and Hausmann, be taken as such. This is as follows: "The eggs of the wooly apple-tree louse are so small as not to be distinguished without a microscope, and are enveloped in a cotton-like substance furnished by the body of the insect. They are deposited in the crotches of the branches and in the chinks of the bark, at or near the surface of the ground, especially if there are suckers springing from the same place. The young, when first hatched, are covered with a very short, fine down, and appear in the spring of the year like specks of mould on the trees." I have so far failed to find eggs during the winter in this cottony substance, although searching carefully for them with a magnifier. But, the statement quoted, corresponds with the idea that the oviparous female is apterous, as the eggs are "enveloped in a cotton-like substance," whereas, the winged female as Prof. Verrill states correctly, has but little down on the body, in fact, is almost naked. An additional fact must also be borne in mind, that neither Knapp or Hausmann were so fortunate as to discover a winged specimen, and so marked was the absence of this form that they concluded they never acquired wings.

Taking all these facts into consideration, I am forced to the conclusion, that the theory advanced by Prof. Verrill and repeated by Mr. Mann, in his communication to the *Rural New Yorker*, that they spread by the oviparous female flying from tree to tree and depositing eggs, is incorrect.

While it is possible that a portion of the broods pass the winter in the egg state, I am of the opinion this is not their normal method.
The winged individuals are undoubtedly chiefly females, and most likely viviparous and very likely do aid in spreading the species by passing to other trees, and depositing living young in favorable localities, but it is not likely that a female wanders much after she commences giving birth to young aphides.

Blot, Hausmann and other early writers on this subject, supposed the species spread, by being blown about by the wind, the cottony substance aiding.

The chief remedies have already been mentioned; and so far as those insects infesting the trunk are concerned, will prove effectal if carefully and properly applied.

SCHIZONEURA RILEYI. Thos. (*Eriosoma ulmi*, Riley). The Wooly Aphis of the Elm-tree.

This species was originally described and named by Prof. Riley, in his first annual report, as *Eriosoma ulmi*, but as this specific name is preoccupied by *Aphis ulmi* of *Linnæus*, which was afterwards transferred to *Eriosoma* by Sir Oswald Mosley, and as the two appear to be distinct, it is necessary to give this another specific name; I have therefore named it after the original describer. It is always preferable where it is possible to do so, to give these insects specific names, which indicate the plant on which they feed, but in this case all the changes possible on the scientific name of the elm have been rung; two species in fact previous to this having received the name of *Aphis ulmi*, the second by Ratzburg, which has since been transferred to *Tetraneura*.

This species, which is quite common in this State, occasionally does considerable injury to the white elms which are planted for shade or ornament. They usually congregate in clusters on the limbs and trunk, causing an unnatural and knotty growth of the wood somewhat similar to the knots produced on the roots of the apple tree by the preceding species. Their habits so far as observed, appear to be very similar to those individuals of *E. lanigera* which inhabit the trunk of the apple-tree.

The description given by Riley is as follows, which I give in his own words, in order to afford the reader an opportunity of comparing it with the description of the *E. ulmi* of Europe.

Color, dark blue; length to the tip of the closed wing, exclusive of the antennæ, 0.12 inch; wings hyaline, three times as long as wide, and more pointed at the end than *E. pyri* (*E. lanigera*). Costal and sub-costal veins, and that bounding the stigma behind, robust and black. Discoidal veins, together with the third forked and stigmal veins, all slender and black, the forked vein being as distinct to its base as are the others, with the fork about one-third as long as the vein itself, and curved, in an opposite direction to the stigmal vein. Antennæ, six-jointed, and of the same color as the body; joints 1, 2, 3, 4 and 6 of about equal length, joint 3 thrice as long as either. Legs of the same color as the body. The young lice are narrower and usually lighter color than the mature individuals, varying from flesh or pink to various shades of blue and purple. The cottony or wooly secretion by these lice is very abundant, usually covering them from view, and is very white. They generally appear in May or early part of June, and by the latter part of June or first of July the winged individuals are seen.

Riley says that for these he has found by experiment, that a washing with a weak solution of cresylic soap will kill them all instantly. He also adds that they are preyed upon unmercifully by a species of lace-wing fly, which he names *Chrysopa eriosoma*.

The characters of the *Aphis ulmi*, *Linn.*, *Eriosoma ulmi*, Sir Os. Mosley, are given as follows by Walker: Dull black; antennæ stout, black, moniliform, slightly setaceous, shorter than the body; abdomen very short, slightly covered with gray filaments; legs moderately long; wings colorless, very much longer than the body; wing-ribs, black; stigma and veins, brown, stigma linear, rather long, actuely angular at each end; distance between the first and second veins at the tips full eight times that between them at the base; third vein nearer to the second towards the base than at the tip, much nearer to the second at the tip than the second is to the first.

SCHIZONEURA PINICOLA. n. sp.

This singular and beautiful specimen was discovered the 20th of April 1878, at Carbondale, Illinois, on the tender shoots of young white Pines, feeding on the base of the young leaves or the sheath around the base of the new growth. Their presence is indicated by slender snow-white, silky webs. They are usually covered with a clear white, cottony secretion which appears to shoot out from the body in little ribbon-like flakes.

Wingless specimen,—when freed from their cottony covering are almost uniformly pale green; before their covering is disturbed, they are covered with a white powdery substance on the back, green dots showing through it along each lateral margin. The form is somewhat elongate-ovate, the head being quite broad and blunt, and in some specimens grooved above near the front; the body is rather rough above, with transverse ridges and tubercles. The antennæ are scarcely half the length of the body, six-jointed, the fourth joint is shorter than the fifth or sixth. Honey-tubes wanting; no tail apparent.

Winged specimen,—Unfortunatly I was unable to examine the winged form when it made its appearance, and can now describe it only from a single specimen mounted in Canada balsam. Body imperfect and somwhat shrunken; the abdomen is less than the thorax; the widest point being the anterior portion of the meso-thorax; the prothorax is very short, it and the head, which is broad, being brought closely together the latter, apparently, somewhat drawn into the former. The eyes are large and black; the front of the head rounded and blunt. The antennæ more than half the length, but not reaching to the tip of the body; third joint longest, nearly, but not quite equal in length to the fourth and fifth united, its inner side with a series of little transverse ridges: fourth, fifth and sixth joints about equal in length; the sixth with a little spur at the end.

Wings erect in repose, anterior pair with the third discoidal vein once forked; posterior pair with two branch veins; unusually delicate and perfectly transparent, so that when placed on a glass slide and held toward the light they can scarcely be traced by a pocket lens, (I speak only of them in the balsam); veins very slender and delicate. The first and second discoidal veins arise very closely together, but diverge rapidly, the second being much more oblique than the first; the third is wholly obsolete at the base about half the distance to the fork; the fourth vein is long, at its base it curves slightly for a short distance, then is nearly straight, running obliquely to the hinder portion at the apex of the wing. The costal and sub-costal veins are more than usually distant from each other. The stigma is scarcely apparent and is unusual in form, gradually narrowing from its base it curves around the margin of the wing to the apex, in the shape of a sickle, the point being elongate and attenuated.

According to Passerini's arrangement, this will fall into *Schizoneura;* the venation and form of the stigma approaches somewhat closely to Koch's *S. compressa.*

SCHIZONEURA PANICOLA. Thos.

In Bulletin No. 2, of the Ill. State Labratory of Nat. Hist., published in December 1877, I described a new species of root plant-louse as *Tychea panici.* In a note, inserted while the article was going through the press, I announced that what was supposed to be the winged form had been discovered, and that it would probably fall in the genus *Schizoneura.* The connection between the two was not absolutely traced by Mr. Pergande, the discoverer, but the facts were sufficient to cause him to believe they were identical. A more careful examination has sufficed to convince me that in this he was mistaken, at least the differences between the two are such as to require them to be described and considered as distinct.

The winged species to which the name *Schizoneura panicola* has been given, so far as it can be described from recent alcoholic specimens, presents the following characters:

Winged female.—The front wings with the third discoidal vein once forked; third vein obsolete at base; first and second veins arising very near each other; stigma short, rounded behind; fourth vein nearly straight; costal bent outward next to the base, leaving a rather wide space between it and the sub-costal. Antennæ short, reaching about to the base of the front wing; slightly hairy; third joint rather longer than the fourth and fifth united; sixth slightly longer than the fifth, with a very short, indistinct, blunt spur at the tip. Beak rather long, reaching nearly to the hind coxæ, slightly hairy. Eyes present and of the usual size or nearly so.

Wingless female (probably not fully developed). Very broadly ovate and very convex being sub-orbicular; antennæ reaching about to the end of the thorax, rather thick and heavy and not tapering, the apical joints, if any difference, rather thicker than the middle ones; third joint longest but not quite equal to the fourth and fifth united; fifth rather longer than the fourth, gibbous on one side at the tip; sixth nearly as long as the third. Beak, long reaching fully to the hind coxæ. Color of the alcoholic specimens reddish yellow; eyes minute and black.

Found on the roots of *Panicum glabrum* and other grasses by H. Pergande, at St. Louis, Mo., in November.

The difference in the length of the beak will certainly distinguish this from *Tychea panici*, even supposing the antennæ in the latter to be undeveloped.

Passirini in "*Gli Afidi Ital.*" describes a species which may be identical with this. I give his description in full as a means of comparison, and of determining this point.

Schizoneura venusta Pass.

Wingless female—Ovate-convex, pale green or sometimes reddish; head, three anterior dorsal fasciæ, a quadrate discoidal spot, two posterior fasciæ and marginal points, black. Rostrum extending about to the middle legs. Length (of body) 1 mm.

Winged female.—Head and thorax black. Abdomen greenish yellow or reddish; two anterior fasciæ, a sub-rotund discoidal spot and marginal points, black. Nectaries tuberculiform and black. Length 5-4 to 1 mm.

Pupa yellowish, head and thorax pulverulent. Found on roots of *Setaria viridis*, *S. glauca*, *S. italica*, *Panicum glabrum*, *Eragrostis megastachya* and *Ceratochloa australis*, in Autumn.

SCHIZONEURA QUERCI. Fitch. The "Oak Blight," or Wooly Aphis of the Oak.

This species is found in the northern part of this state, upon oak limbs. Fitch says it is very similiar to another species found on the bass-wood.

The winged individuals are black throughout, slightly dusted over with an ash-gray powder.

The fore-wings are clear and transparent; the stigma is dusky, the rib-veins black, and the third discoidal vein with the basal portion abortive nearly or quite to the fork. The length to the tip of the wings is (0.16), a little over one-eight of an inch.

SCHIZONEURA TESSELLATA. Fitch. The Alder Blight.

This species is found on the under side of the branches of the Alder (*Alnus rubra*), crowded together and concealed beneath a covering of snow-white down. Wingless individuals, dull bluish back; the back of the segments are marked with strongly impressed lines, and covered with white down in square, checker like spots. Length to the tip of the abdomen, 0.16 inch.

SCHIZONEURA IMBRICATOR. Fitch. The Beech-tree Blight.

This species occurs on the under side of the branches of the beech, covered with a coating of white down; and, according to Dr. Fitch, from whose report the discriptions of this, the preceding and following species are copied, when the branch on which they are situated is jarred, a shower of tiny drops of water-like fluid falls from these insects. It is possible it is identical with the European.

Schizoneura fagi. Linn. Beech Blight.

Black; three last segments of the abdomen, blue pruinose; longitudinal vein, and a line on the middle of the inner margin, black. Winged females have the abdomen yellowish, with a black spot on the disk; legs pale. Larva, pale, with two fuscous dorsal stripes; posterior half of the abdomen covered with a tuft of cottony down, from which proceed two longer and coarser filaments. Length to tip of wings, 0.22 inch.

Schizoneura strobi. Fitch. Pine-tree Blight.

"Black, pubescent, subpruinose, a dorsal row of white meal-like spots on the tergum; fore wings with the costal margin, the apical and two inner basal nerves, black. Length .20. Common on branches of the White Pine, giving the bark of infested trees a peculiar black appearance. Belongs to a nondescript genus intermediate between this and Lachnus. Male, female." (Fitch).

Schizoneura ulmi. Linn. The Elm-leaf Aphis.

This species is the one so commonly seen congregated in immens numbers on the under side of Elm leaves, cupping and blistering them.

Wingless female. Broadly ovate in outline and very convex. Antennæ short, not reaching the end of the thorax; third joint longest equal in length to the three following; fourth, fifth and sixth abou equal. General color lilac brown; legs and antennæ pale. No honey-tubes. Body tipped with cottony substance.

Winged individuals. Wings erect in repose. transparent, with rathe small, dark veins; stigma dusky, fusiform, rather large; their discoida vein obsolete at base about half the distance to the fork. Antenn about half the length of the body. General color dark brown, almos black; legs and antennæ black, wings transparent.

SCHIZONEURA! FUNGICOLA. Walsh.

Syn. *Eriosoma fungicola.* Walsh.

Mr. Walsh describes this species, which I have not seen, as follows: "From recent specimens. Body black, with a plum-like bloom; basal half of abdomon and whole of venter yellow. Antennæ and legs black. Wings hyaline with a dusky tinge; veins dusky, black on the basal half of the costa; third discoidal hyaline nearly to its fork; stigma palish brown. Numerous individuals, unaccompanied by larvæ, occurred on a large moist fungus a hundred yards from the nearest trees, which were all oaks. Beat solitary individuals unaccompanied by larvæ or wooly matter, on two separate occasions from oaks, which when dried differ only from the dried specimen of those found on fungus by the metathorax being varied with pale greenish, as well as the base of the abdomen. Lenth to tip of wings .12—.13 inch.

The antennæ do not quite attain the base of the first discoidal when the wings are expanded, and the stigma is rather more than twice as long as wide."

He also discribes a second species which is undoubtly but a variety of *S. fungicola.*

SCHIZONEURA CARYÆ Fitch. Hickory-blight.

Syn. *Eriosoma caryæ* Fitch.

The undersides of the limbs, particularly of bushes and young trees in shaded situations coated over with a white flocculent down, covering and concealing multitudes of wooly plant-lice which are crowded together upon the bark, sucking its juices; the winged individuals of a black color, with the head, scutel and abdomen covered with a white cotton-like substance, their wings somewhat hyaline, the forward pair with an oval salt-white spot or stigma towards the tip of their outer margin; their veins all very faintly traced or abortive. Length to the tip of the wings 0.12.

It was found common upon walnut bushes growing along Henderson river, in Illinois, a few years since. (Fitch).

I have not observed this species in the Southern part of Illinois, though it is very probably found throughout the State.

SCHIZONEURA CORNICOLA. Walsh.

Syn. *Eriosoma cornicola,* Walsh.

Differs from the preceding only in the body being entirely black. Numerous individuals, unaccompanied by any flocculent matter and so far as I recollect by larvæ, occurred in September on the lower side of the leaves of the red osier dogwood. (Walsh).

Genus GLYPHINA. Koch.

This genus differs from Schizoneura chiefly in the fact that the hind wings have but one branch vein. It may be defined as follows: The beak short; antennæ short, not reaching beyond the tip of the thorax, transversely corrugated; six jointed, the two basal joints very short, the third longest, about or nearly equal to the three following; the sixth joint sometimes very short, while in other cases it equals the fifth. Front wings usually have the third vein once forked, but sometimes the same species varies in this respect and occasionally presents an individual with this vein simple. Hind wings with one oblique or branch vein. Honey-tubes obsolete or wanting.

Mr. Monell's genus *Colopha* must be considered a synonym, unless we consider the slight variation in the length of the sixth joint as a generic character, which does not enter into the diagnosis of his genus. Koch evidently considered the fork of the third discordal vein of the forewing as characteristic of his genus, as he speaks of the simple form observed in *Gl. betulæ* as exceptional and unfortunately figures this exceptional form.

Thalaxes. Westwood. as modified, or rather as explained by Walsh is also a synonym. It is true that Westwood speaks of his species as a synonym of *Vacuna* Heyd, but the number of joints in the antennæ does not appear to have been relied upon as a character, the supposed normal position of the wings, when at rest, being apparently the governing characteristic.

Mr. Monell who makes *Byrsocripta ulmicola.* Fitch, the type of his genus, gives as a character,"wings in repose usually horizontal." As I have elsewhere stated, when first taken from the galls the wings are often seen in a semi-horizontal position, but the appearance, even at this time shows that this is not their normal position, which is evidently erect.

Glyphina ulmicola. Fitch. The Aphis of the Elm-leaf Cockscomb gall.

Syn. *Byrsocrypta ulmicola.* Fitch.
Thelaxes ulmicola. Walsh.
Pemphigus ulmicola. Pack.
Colopha ulmicola. Monell.
Glyphina ulmicola. Thos.

This species forms the cone-shaped galls, so common on the upper side of the leaves of young white elms. These galls, which are often an inch or more in length, vary in height from one to three-quarters of an inch; they are compressed and grooved on the sides, and perpendicular, showing tooth-like, conical projections at the top: opening by a long slit on the under side. The inside is wrinkled perpendicularly into deep plaits or folds, and occupied by one female and her progeny, some of which may often be seen strolling out on the under side of the leaf.

My examinations of these insects show the characters of the species to be as follows:

Winged individual.—Length of body about .05 inch, to the tip of the closed wings .08 inch, thorax black; the abdomen dull black or greenish black above; paler, obscure green beneath; slightly pruinose. Antennæ very short, scarcely reaching beyond the insertion of the fore-wings; first and second joint very short; third much the longest, about equal in length to the three following taken together, fifth and sixth about equal, all except the basal joints transversely corrugated. Wings transparent, resting somewhat flatly on the abdomen while in the gall, but after the specimens have been removed for a while, will assume the usual erect position, the costal and sub-costal veins dark; the latter robust and undulating; stigma prominent; the first and second dis-

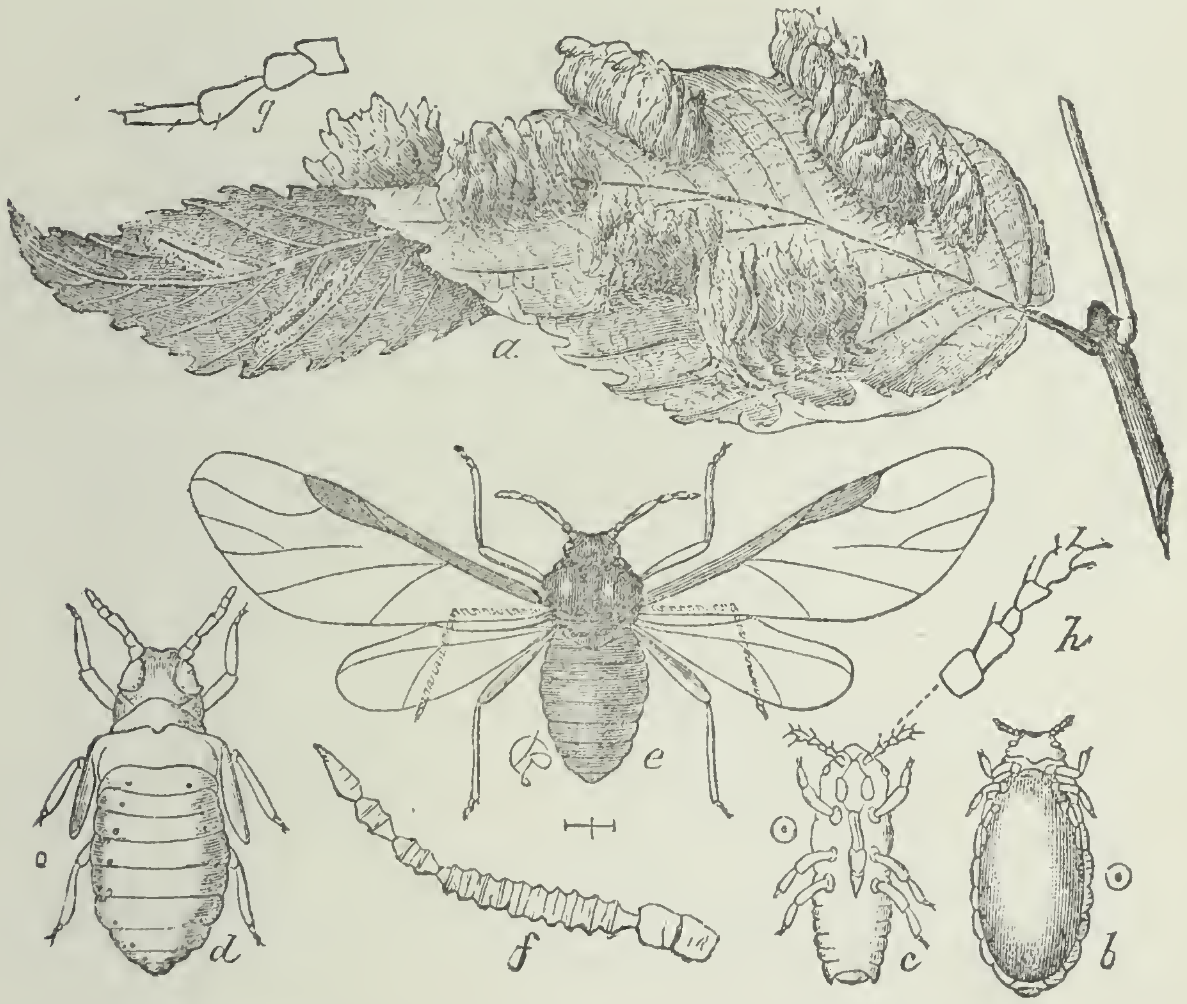


Fig 21—Aphis of the Elm-leaf Cocks-comb Gall—*Glyphina ulmicola:*

a, Leaf showing galls from above and beneath; nat. size. *b*, Impregnated egg, surrounded by skin of true female. *c*, Newly born young of second generation, ventral view. *h*, Its antenna. *d*, Pupa of same, dorsal view. *e*, Winged female. *f*, Her antenna. *g*, Antenna of stem-mother—all enlarged.

coidal veins are close together; the third obsolete at base, emits the fork about midway its length (counting to the imaginary point of insertion). No honey-tubes; the abdomen expanding near the tip.

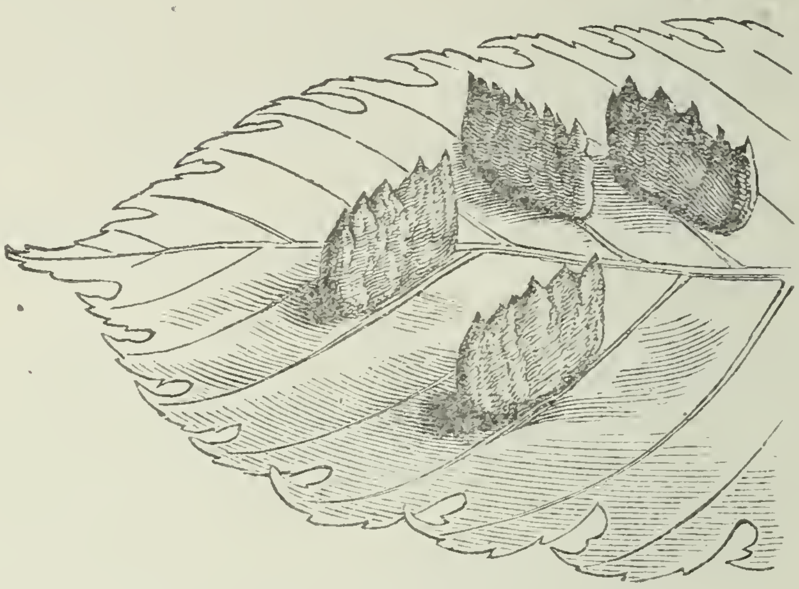


Fig. 22—Elm-leaf Cocks-comb Gall.

The *wingless individuals* are very short, broadly ovate, and very convex; olive green, covered slightly with a white powder; antennæ and legs very short.

Mr. Monell calls attention to the errors in the bibliography of this species, in his article in the *Canadian Entomologist*, as follows: "The bibliography of this species really seem, like a 'Comedy of Errors.' Dr. Fitch placed it in a wrong genus; Mr. Walsh removed it to *Thelaxes*, and refers to N. Y. Rep., I, 257, instead of I, 357, The *American Entomologist* omits to index it for p. 224. Mr. Packard (*Guide*, p. 525), mentions *Thelaxes ulmicola*, Walsh, while on the next page he speaks of *Pemphigus ulmicola*, (Fitch), and refers to figure 525, which is from an electrotype of the identical woodcut first published by Messrs. Walsh and Riley, in the *American Entomologist*, under the name *Thelaxes ulmicola*, Fitch. Mr. Packard's figure 525 is, therefore, my *C. ulmicola*, and, indeed, I have so far failed to find any other mention of *Pemphigus ulmicola*, Fitch." But the writer is mistaken in saying that it is not indexed for page 224, in the *American Entomologist*, as it is indexed for this page, under "Cockscomb elm-gall," and "*Thelaxes ulmicola*."

GLYPHINA ERAGROSTIDIS. Middleton.

Syn. *Colopha eragrostidis*. Middleton.

Winged individual.—General color reddish-brown; head black; prothorax yellowish, rest of the thorax and abdomen reddish-brown; veins of the wings dark; stigma pale brown.

Wings, when first seen horizontal, but becoming erect, formed and veined as usual; the third vein in the anterior pair with only one fork and obsolete nearly half way to the base of the fork; the first and second veins approximate very closely at the base. Posterior pair with but one discoidal vein.

Antannæ six jointed, with the sutures between the third and fourth and between fifth and sixth transparent; first and second joints short; third about equal to the fourth, fifth and sixth united; the fourth and fifth nearly equal in length: sixth very short, but little exceeding the first and second united. The antennæ, as compared with the body, are very short, scarcely reaching to the base of the front wings; not tapering,

Wingless individual.—Body covered with a cottony substance; beak short, not extending to the base of the second pair of legs. No honey-tubes. Length of the body .06 of an inch; to tip of wings .10 of an inch.

This species was found September 1st, 1877, on the upper leaves and fruit stems of a species of grass (*Eragrostis poæoides* var. *megastachya*), the blades of the grass folding over the insects.

It is also found on some species of *Panicum*.

GENUS VACUNA. Heydn.

This genus agrees in most of its characters with *Glyphina*, the third discoidal vein is once-forked; the hind wings have but one branch vein. But it differs in having only five-jointed antennæ

I know of no species found in the United States that can with certainity be referred to this genus.

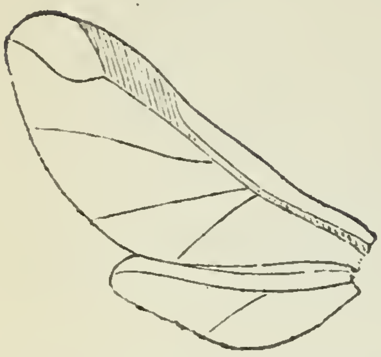
For venation of wings see fig. 21 *e*.

SECTION 2—PEMPHIGINI.

This section corresponds exactly with Buckton's sub-family *Pemphiginæ*, and is distinguished by the following characters:

The front wings have three discoidal veins, all simple; the hind wings have one (Fig. 23, see end of report) or two (Fig. 24) oblique or branch veins. Antennæ six-jointed. Some of the species which belong to this group, appear to, and according to the authorities we have on the subject, do place their wings horizontally in repose. I have as yet, found no species with this habit, which belongs to this section; as heretofore stated, I have observed gall-inhabiting species with the wings sub-horizontal while in the gall, but assuming the erect position after coming into the open air, hence I conclude the normal position of these organs, in these species, is erect.

Fig. 24.



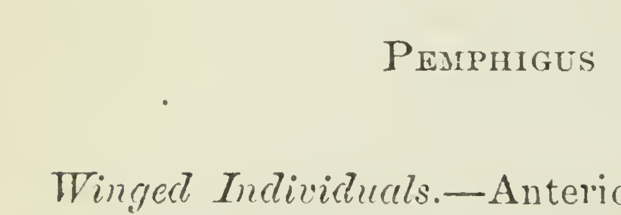
Wings of *Tetraneura ulmi.*

The habits of the species of this section, have already been alluded to.

Genus PEMPHIGUS. Hartig.

The species have the third discoidal vein of the front wings simple, that is, without any fork or division; the hind wings have two branch veins. (See Figs. 23 and 25.) The antennæ, which are quite short, not extending beyond the end of the thorax, are six-jointed, the third joint longest.

Fig. 25.



Pemphigus vagabundus, winged female.

Pemphigus fraxinifolii n. sp.

Winged Individuals.—Anterior wings with the third discoidal vein simple, arising from the second vein a short distance from the base of the latter, running almost directly outward toward the apex of the wing; second vein also very oblique and arising very close to the first vein; first vein somewhat dim, sub-obsolete, slightly curving outward as it approaches the margin of the wing; fourth vein curves very slightly near the base, the remainder being almost straight. Stigma semi-opaque, elongate-rhomboidal, sides nearly parallel, ends with about the same slope; length about three times the width. Sub-costal vein quite prominent, somewhat distant from the costa, curving slightly inward or backward where the two branch veins arise. Antennæ short reaching but slightly beyond the end of the thorax; third joint longest, nearly equal to the fourth and fifth; fourth slightly shorter than the sixth; sixth with a small spurs at the tip. Posterior wings with two discoidal veins which arise from the same point. Color of winged specimen after long immersion in alcohol; head dark, prothorax pale, thoracic lobes dark; abdomen pale dull yellow, with marginal sutures dark in some specimens; wings transparent, with a slight tinge of milky white; veins very delicate, and generally pale. Length of body about .07 inch.

Wingless specimen.— Very broadly ovate, length, in some scarcely exceeding the widest point; antennæ very short; eyes quite small; dark.

Dr. Bundy, from whom the specimens were obtained, furnishes the following note in reference to them; made at the time they were discovered.

"On ash, June, Sauk City, Wisconsin. On the under of surface of much deformed, crumpled leaves. Female; abdomen dirty green, somewhat darker at the base, sprinkled with mealy-white grains at the apex; head, throax, eyes, antennæ and legs dingy black; wings pale, unmarked." The particular species of Ash (*Fraxinus*), which it inhabits Dr. Bundy has not informed me.

This can scarcely be the *Aphis fraxini* of Fabricius, which is found on the branches of the European ash, (*Fraxinus excelsioris*). It resembles in some respect, the *Prociphilus bumeliæ*, Schrank, to which Koch, with a mark of doubt, refers *A*, *fraxini* Fab., but, judging from Koch's figures, it differs from that species as follows: in Schrank's species, the third discoidal vein does not arise from the second, nor does the second approximate very closely at its base to the first, and moreover it is a very large species. The two agree somewhate closely in color and markings, in the obliquity of the third discoidal vein, form of the stigma and curveture of the subcostal vein, and also in the form of the apterous specimens. It is also more than probable that the alcohol has caused the specimens described to shrink and lessen the size. If it should hereafter be ascertained that this species is from the European ash it will be best to suppress my specific name and consider it as a varity of *Pociphilus bumeliæ*.

Since the above was written, Prof. Bundy has furnished the following item; "Found on *F. quadrangulata*, Mx. Leaves much twisted and deformed, especially at the end of infested twigs, but no gall proper."

PEMPHIGUS RUBI. n. sp.

This species, which was first discovered by Prof. G. H. French, at Carbondale, Illinois, in April, 1878, and mounted and described (in *Mss*) by Miss Nettie Middleton. presents some difficulties when we attempt to discover its affinity or locate it strictly according to characters and habits. It is possible that in a rigid classification it would require the construction of a new genus, yet its external characters appear to be decidedly Pemphigian.

Winged Specimens.—Antennæ very short, not more than three times the length of the head, not reaching quite to the end of the thorax; rather stout; third joint longest, rather longer than the fourth and fifth united; second, fourth and fifth about the same length; sixth about two-thirds the length of the third, with a short blunt spur at the tip; the third joint usually presents about six little transverse wrinkles, or pustules. Anterior wings with the third discoidal vein simple (not forked); very thin and delicate but slightly smoky; veins, with the exception of the sub-costal very slender and pale brown; the subcostal is rather broad and brownish; costa semi-opaque and brown, the first and second discoidal veins arise usually from the same point, but in some the space between them is distinct, first nearly straight, second curving slightly very oblique and diverging; third vein obsolete at the base, (usually) straight; fourth curves slightly at the base, rest straight. Stigma elongate, fading gradually into the subcostal at the base and rounded behind.

The above description is from the mounted specimens, when living, the veins of the wings are dark.

In the hind wings, the sub-costal vein curvers very strongly at the point where the two branch veines arise, so that the second vein appears to form its extension. In one specimen, the second branch vein is distinctly forked; in some cases the two branch veins appear to arise from the same point, in others they are distinctly separated. Beak reaching slightly beyond the base of the middle legs.

No wingless specimens obtained.

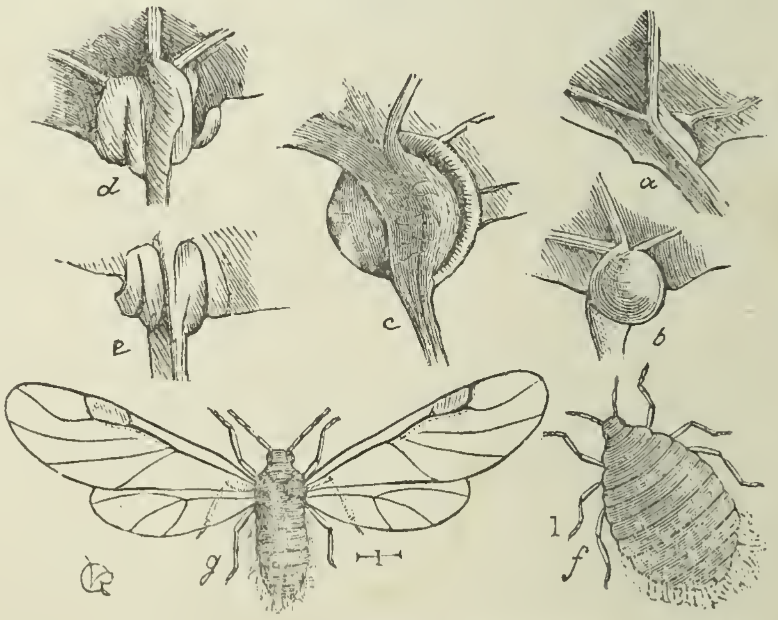
Body apparently black, but covered when living with a bluish-white cottony substance. No honey-tubes.

Size small.

Found on the underside of the leaves of the common raspberry, (*Rubus occidentalis*) along the mid-rib.

It is possible that these specimens were accidently on the raspberry, they closely resemble that found by Profs. Bundy on *Populus tremuloides*, which I have considered provisionally as belonging to *Pemphigus populicaulis*.

Fig 26.



The Poplar-leaf Gall-louse. *Pemphigus populicaulis.*

a, The incipient gall on the under side of the leaf. *b*, The corresponding bulge on the upperside. *c*, The fully formed gall, showing the lips slightly separated, so as to permit the escape of the mature insects. *d* and *e*. Incipient double galls, one being located on each side of the mid-rib. *f*, The wingless female, with the cottony secretion attached. *g*, The winged insect. The marks at the sides of *g* and *f* indicate the natural size.

Pemphigus populicaulis, Fitch. The Poplar-leaf Gall-louse.

This species forms the swellings or galls about the size of a bullet, so often seen on the leaves of the cotton-wood (*Populus monilifera*) at the point where the blade joins the stock or petiole. These galls often assume a reddish tint, and sometimes grow to the size of a small marble; having a mouth-like orifice on the under side and a cavity within where the lice reside. As Dr. L. Baron, has given an account of this species in his Third Report, it is unnecessary for me to notice it further than to give a description of the species, which is omitted in that report.

The galls usually begin to appear early in May, and at first are occupied by a single wingless female, which in midsummer becomes the mother of a numerous progeny, often amounting to one-hundred and fifty in number. Dr. L. Baron, is of the opinion, from some observation he made, that they pass the winter in the egg state, and that the eggs are placed at the base of the buds.

The young lice are of a pale greenish or whitish color, variable in size, but usually about three-hundredths of an inch long. The winged individuals make their appearance about the middle of June. These are of a blue black color throughout, sometimes with the base of the abdomen and legs pale brown. While in the gall, the wings appear to rest horizontally on the back, but when they leave this they are held erect in repose, as is usual with the species of this genus; they are whitish and not perfectly clear, being more or less dusted over, as is the body, with a white powder; the marginal vein is robust and blue-black from the base to the stigma, but slender beyond that point; the rib vein is also robust and of the same color till it reaches the stigma, where it is widened to twice its previous thickness, forming a broad blue-black margin along the inner side of the stigma; the stigma is dull white; discoidal veins, pale yellow; the first of these veins is straight, the second arises almost in contact with it, and is straight nearly to its tip, where it curves slightly toward the inner margin; the third vein obsolete for about one-fourth of its length at its base. Length to the tip of the abdomen about one-tenth of an inch; to the tips of the wings, one-seventh of on inch.

Specimens sent to me by Mr. W. F. Bundy, of Sauk City, Wis., were found on the Aspen (*Populus tremuloides*) and are probably the same as the above described. The following is the description taken from alcoholic specimens:

Winged individual.—Front wings with the three simple branch veins very slender and pale, obsolete at the base; fourth vein curves regularly and slightly at the base and before it reaches the apex recurves; stigma rather short, acute angled at the base; posterior margin rounded to the apex, dull yellowish or light brownish with a broad brown posterior or inner margin. Antennæ short scarcely reaching beyond the tip of the thorax, third joint as long or longer than the fourth and fifth united, sixth joint a little shorter than the third, nearly equal in length to the fourth and fifth united, tipped at the end with a small rudiment of another joint; whole antennæ marked distinctly with transverse ridges. Without honey-tubes. Posterior wings with two branch veins arising from nearly the same point, speaking more exactly the subcostal vein soon after leaving the base apparently divides into three branches, the second branch apparently forming the continuation of the subcostal vein.

The following notes in regard to color were taken by Prof. Bundy from fresh specimens. *Winged female*—General black color, smoky brown on the ventral side of the abdomen, indistinctly striped above with transverse lines. Antennæ and eyes black. Wings dingy white with widened veins, forming conspicuous dark spot near the margins. Honey-tubes white. On petioles, young on under surface of the leaves.

PEMPHIGUS? FORMICARIUS. Walsh.

This and the next species are unknown to me, I give Mr. Walsh's descriptions as I find them, and in his own words.

Two kinds of larvæ occurred in company; the first, when recent, scarcely twice as long as wide and whitish; the second, when recent, three times as long as wide and cinereous. From the latter I bred five *winged* individuals, which differed as follows from the description of *P. pyri* Fitch: The size is somewhat smaller; the prothorax and abdomen of the living insect are blue black, pruinose, in the dried specimen pale yellowish-brown, the abdomen much varied with fuscous; the thorax and head, both in the living and dried insect, are opaque blue-black. Legs yellowish-fuscous. Wings hyaline slightly fumose at tip; veins not margined with brown; the second discoidal is not more robust than the first and does not taper; the costa and the anterior half of the stigma are very pale fuscous or cinereous, the latter a little darker; the posterior half of the stigma is black. In the hind wings the apex of the black rib-vein or sub-costal is nearly twice as far from the apex of the second discoidal as that is from the apex of the first discoidal.

Length to tip of wings .2 inch; expanse .33 inch. Five specimens. The stigma is much hunched posteriorly, more acute at the basal than the terminal end, and rather more than twice as long as wide. Bred October 11th, from larvæ found 8 or 10 days before in the nest of *Formica aphidicola* Walsh, attached to the root of what appeared to be a perennial herbaceous plant.

PEMPHIGUS? FORMICETORUM. Walsh.

Differs from *P. pyri* as follows: The size is much smaller; the second discoidal is not more robust than the first and is of uniform robustness throughout; the third discoidal is of equal robustness with the first; the fourth or stigmal vein is of equal robustness with the first and does not taper; in the hind wing the apex of the second discoidal is nearly twice as far from the apex of the rib-vein as it is from the apex of the first discoidal.

Length to tip of wings .09--12 inch; expanse .20--.25 inch. The stigma is three times as long as wide, very acute at the basal end, and not materially wider than the costa. Found winged specimens May 25th, in company with many larvæ and pupæ, and obtained others in the course of June, all in the nest of the same yellow ant before mentioned. A specimen of the wooly secretion of the larvæ which I have preserved appears under the lens like cotton wool, but at least ten times as fine and snowy white.

PEMPHIGUS PSEUDOBYRSA. Walsh.

Syn. *Byrsocripta pseudobyrsa.* Walsh.

Pale obscure greenish, pruinose. Antennæ sometimes obfuscated, always with the 6th joint unguiculate. Thorax blackish pruinose. Joints of abdomen with obscure fuscous fasciæ. Legs with the tarsi, and sometimes the tip of the femora, obfuscated. Wings whitish subopaque, costa and stigma yellowish; veins hyaline except the costals which are pale yellowish-brown, the subcostal generally blackish at base and black at the stigma but not thickened there. Hind wings with all the veins hyaline. Length to tip of wings .10-13 inch.

The antennæ scarcely attain the base of the 1st discoidal of the expanded wing, and the stigma is about three times as long as wide and very acutely pointed at its basal end. Forms near the middle of the midrib of the leaf of the cotton-wood (*Populus angulata*) what appears above as a smooth, green, semicircular, compressed gall; crowned by the midrib and from one quarter to two fifths of an inch long, but which below is entirely open, the sides of the leaf bending down together so as to touch each other and conceal the opening. The insects oten wander from this false gall and associate with *Aphis populifoliae* Fitch. Comes very near *popularia* Fitch, (the gall of which is unknown) but that species has the discoidals "blackish" and the "antennæ only two-thirds the distance to the wing-sockets." Differs from *populi globuli* and *populivenae* Fitch in the sub-costal not being thickened at the stigma and also in the peculiar structure of its gall.

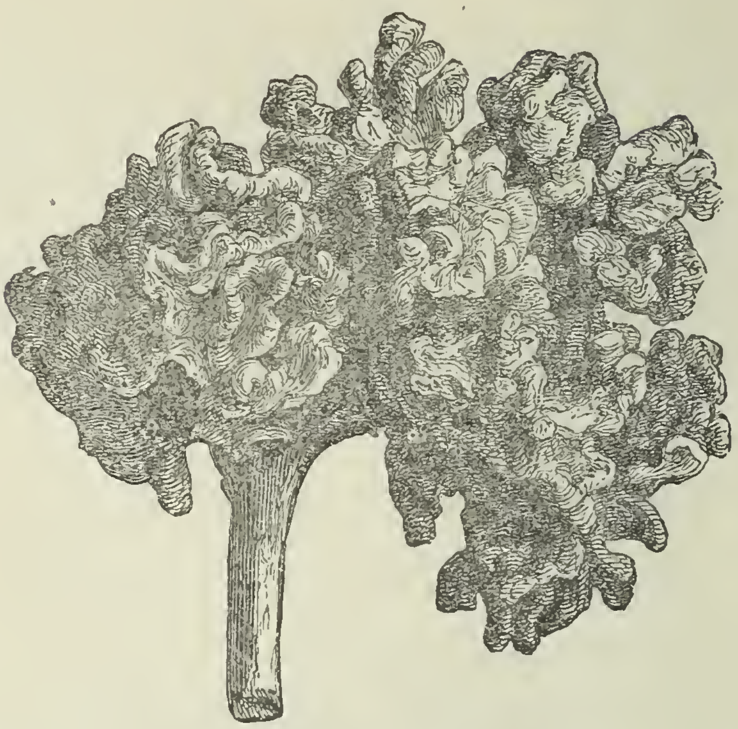
The recent larva is densely covered with white pruinescence, on removing which it is yellowish, with only the eyes and tarsi blackish, and the disk of the abdomen freckled with reddish (Walsh).

PEMPHIGUS VAGABUNDUS. Walsh. The Vagabond Gall-louse.

Syn. · *Byrsocrypta vagabunda* Walsh.

This species produces a rather large, irregular gall on the tips of of the twigs of certain cotton-woods, and also occasionally on balsam poplars, which somewhat resemble the flower of the double cockscomb of our gardens. These galls turn black in winter, giving the

Fig. 27.



Gall of Pemphigus vagabundus.

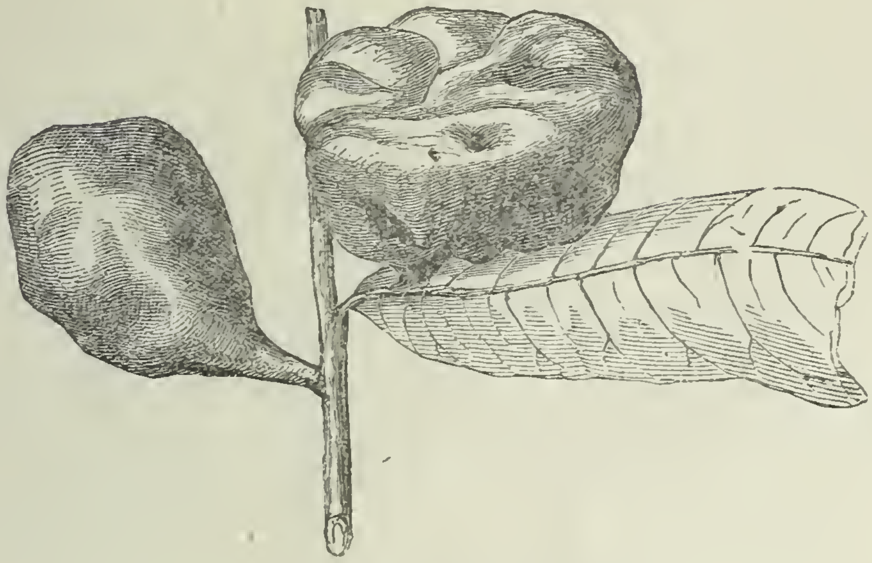
tree a singular and rather unsightly appearance after the leaves have fallen off. The winged insect generally makes its appearance in September; (Vagabond Gall-louse. Fig. 25) the body is black, and about one tenth of an inch long; the expanded wings measure rather more than one-third of an inch from tip to tip; antennæ six-jointed. The name *vagabundus*, or vagabond, has been given to it on acount of its habit of wandering to a great distance from its place of birth. It is possible as has been suggested, that Dr. Fitch's winged specimens, described as *P. pyri*, belonged to this species.

The original description by Mr. Walsh, is as follows: "Black, polished, with no appearance of pruinescence. Antennæ and legs dull fuscous. Abdomen and venter obscure opaque yellowish, varied with fuscous or sometimes with brown. Wings subhyaline with a whitish tinge, costal and subcostal veins, and one-third of the inner edge of the wing from the tip of the first discoidal to the base of the wings, conspicuously fuscous; the remaining veins in both wings whitish hyaline; costal slightly tinged with brown, stigma pale fuscous brown, its interior vein thickened. Alar expanse .43–51 inch." "Sixth joint of the antenna is two thirds as long as fourth and fifth put together; and the stigma is 3½ times as long as wide, very acutely pointed at both ends. There are four specimens which have a little white pruinescence still attached to their wings. Occurs very abundantly on various forest trees in September."

PEMPHIGUS RHOIS. Fitch. The Sumac Gall Plant-louse.

This species forms tomato-shaped galls on the leaves of different kinds of sumac, which usually arise from the mid-vein at or near the base. The shell of these galls is very thin and the winged lice are found inside, in large numbers in September. The winged individuals have the veins of the wings arranged as in the preceding, but they are much smaller, and the antennæ are only four-jointed.

Fig. 28.



Gall of *Pemphigus rhois*.

PEMPHIGUS ULMI–FUSUS. Walsh. The Red Elm Gall-louse.

This is a very minute species, which forms a solitary, spindle-shaped gall about an inch long, upon the upper surface of the leaves of the red elm. The winged individuals measure only about one-fourteenth (0.07) of an inch to the tips of the wings, and are of a uniform dusky color. An occasional specimen has the third vein partially or fully forked, as in *Eriosoma*, thereby indicating a close relationship to that genus.

PEMPHIGUS POPULARIA, Fitch. Poplar Gall-louse.

A species noticed by Dr. Fitch, wandering up and down the trunk of the balsam poplar, whose habits are yet unknown. It closely resembles the preceding, but its abdomen is green; its antennæ quite short, reaching but two-thirds the distance to the insertions of the wings; the rib-vein not widened along the stigma; length to the tip of the wings about one eighth of an inch. Color black, slightly dusted over with a white powder; the abdomen dull green, with a coating of white flocculent down; sides parallel; wings dull hyaline; the rib-vein black.

PEMPHIGUS POPULI–GLOBULI, Fitch. The Poplar-bullet Gall-louse.

This species produces a green gall about the size of a bullet, globular in shape, on the leaves of the balsam poplar. These galls are situated slightly above the base of the leaf, projecting from the upper surface, with a curved orifice or mouth on the under side; within these reside the lice, some of which are pale green, others very small and dusky, the larger winged ones of a black color. These are found in this condition in July. The winged individuals differ from *P. popularia* as follows: They are uniformly smaller, wings clearer and veins more slender and colorless, except the marginal vein, which is black to the stigma; the abortive basal third of the third vein is traced by a very slender line, which appears to be more distinct than in any of the allied species; the abdomen is dusted over with a white powder, with a black band on the hind part of each segment. Length to the tip of the abdomen 0.07 of an inch; to the tip of the wings 0.11 of an inch.

The gall which this species produces grows from the mid-rib of the leaf slightly above the junction of the blade with the petiole. It grows either wholly on the upper side of the leaf, or with but a small portion protruding from the under side. The winged individuals according to Dr. Fitch are females, which produce eggs of a dull wax color, the eyes of the enclosed larva appearing like two black dots near one end. These eggs hatch in a few moments after they are deposited. The so called eggs of Dr. Fitch, are doubtless the thin egg-like sacks which we have heretofore mentioned, in which the larvæ are enclosed; hence, this method of reproduction must properly be classed as viviparous, or, perhaps more correctly ovo-viviparous.

PEMPHIGUS POPULI-VENÆ. Fitch. The Poplar-vein Gall louse.

This species forms an oblong, compressed, cockscomb shaped gall, on the mid-veins of the leaves of the balsam poplar. These are situated on the upper side of the leaf, with an orifice which opens on the under side; they are of a light red color, varied with yellow. The cavity within as in the others, contains a number of lice. These galls are nearly semi-circular, and half as high as they are long, being usually over half an inch in length, with an uneven surface; their walls thick and britle. They are generally placed near the base of the leaf, though sometimes in its middle.

The following is a description of the species as given by Dr. Fitch:

The female larvæ are dusky on the body and legs; and are quite small, measuring about 0.25 of an inch in length; straight along each side and slightly narrowing from behind forward. The male larvæ are much less numerous, and double their size; are pale dull green with whitish antennæ and feet.

The adult wingless female is as broad as long, measuring from 0.04 to 0.05 of an inch in length, the hind end usually being concave or notched, and the abdomen elevated or humped in the middle; pale dusky with two rows of snow white dots, formed of white powdery matter, along each side of the back, the dots of the inner row being more numerous than those of the outer row; head dark, legs dull yellow and feet dusky.

The winged individuals black, with coarse thread-like antennæ, reaching to the base of the wings. The wings are pellucid and colorless, as are the oblique or discoidal veins; the rib-vein blackish somewhat enlarged along the inner margin of the stigma; marginal vein blackish. Length to the tip of the abdomen, 0.05 inch; to the tips of the wings 0.08 inch.

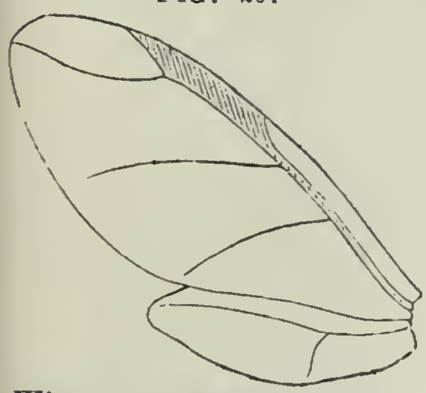
Sub-fam. CHERMESINÆ.

As I have not had an opportunity of examining sufficient material either of this or the following sub-family, I shall make no attempt to define them strictly, nor to do more than give the brief descriptions I find in the works of other authors, and add the descriptions of some two or three specimens I have discovered.

As indicated in the synoptical table of the sub-families, this group may be distinguished by the following characteristics:

The front wings, with but two discoidal veins, both simple, the third vein wanting. The fourth or stigmatic vein is usually long, and appears as a third discoidal vein. (Fig, 29.) But the venation is not regular. The hind wings sometimes have a single branch vein, but in many species this is abreviated, or entirely absent. Antennæ never more than five-jointed, in *Phylloxera* they are only three-jointed; short. So far as the species have been studied, they have been found to be oviparous.

Fig. 29.



Wings of *Chermes laricis*.

Genus CHERMES. Linn.

Antennæ very short, reaching but little beyond the neck when turned back; composed of five joints, the two basal joints short, the remaining ones generally sub-equal in length, the fifth oval. Front wings rather large, transparent, the two discoidal and stigmatic veins appearing as three oblique branch veins; stigma usually elongated and much pointed at the tip. Hind wings with one, more or less distinct, branch vein.

Legs in the winged individuals, rather short, the posterior pair, usually not longer than the middle pair; all rather short; in the aptirous individual very short. Body of the winged individual regularly oval; of the apterous nearly circular and convex. No honey-tubes. Usually more or less covered with a cottony secretion.

The species so far as observed appear to be more particularly confived to to coniferous trees.

CHERMES PINIFOLIŒ, Fitch.

This genus as understood by Dr. Fitch, appears to include those species in which the female is oviparous, but does not extrude her eggs; but clinging to the leaf, the abdomen swells and finally she perishes, leaving the mass of eggs adhering to the leaf, thus showing a close relation to the Coccidæ, or bark-lice. But on the other hand, the winged individuals possess four wings instead of two, which character places them among the Aphides. The other characteristics will be found in the following specific characters of this species. The winged individuals, black, 0.08 inch in length to the tip of the abdomen, 0.12 inch to the tips of the wings; abdomen, dusky-red and slightly covered with down; the wings, dusky and grayish; the rib-vein of the fore wings runs straight to the outer margin forward of the tip, and gives off from its middle, on the outer side, a very oblique branch which runs to the outer margin, its tip producing a slight, angular projection of the margin; on the inner side of the rib-vein there are three branches or discoidal veins, all simple, the third running to the tip of the wing. The hind wings have an angular point on the outer or front margin; the rib-vein sending off one branch; antennæ short, threadlike, and four or five jointed.

Found during the summer, stationary upon pine leaves.

CHERMES LARICIFOLIÆ. Fitch. The Larch Chermes.

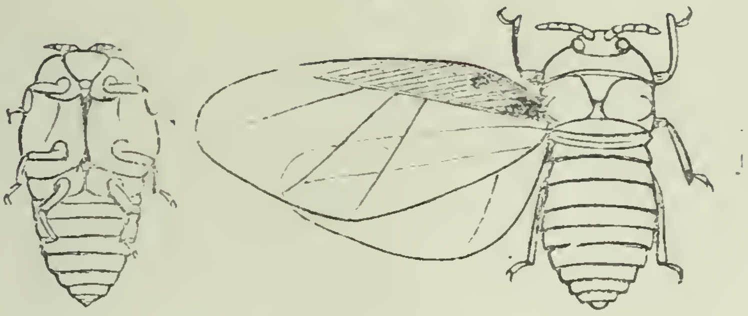
Similar to the preceding species; but found on the leaves of the American larch or tamarack. Shining black, 0.10 of an inch long; abdomen dark green; legs pale or whitish; wings nearly hyaline, with pale brown veins; the large stigma opaque and pale green.

CHERMES (ABIETICOLENS?

Adelges of the Spruce. Packard.

A rather large species mentioned by Dr. Packard as "found in abundance on the Spruce in Maine, where it produces swellings at the ends of the twigs, resembling, in size and form, the cones of the same tree."

Fig. 30.



Adelges of the Spruce.

The specific name is applied provisionally and only for use in this report. This is certainly distinct from the European species *Ch. abietis* Linn., which is much smaller, of a bright reddish-brown color, with the wings tinged with green.

GENUS, PHYLLOXERA. Fonscol.

This genus which has recently been brought into such prominence, on account of the injury done to the grape-vines by one of its species may be characterized as follows: Antennæ three-jointed, the third or terminal joint being much the longest; length usually about one-fourth or one-third the length of the body. Wings large in proportion to the size of the body; overlapping and lying flat upon the abdomen in repose; anterior pair with three oblique veins in the typical form, though the venation is more variable than in the preceding genus. The first and second veins are often united so that the second appears to be but a fork or branch of the first; the third, which in reality represents the stigmatic, is always simple when present, but it is sometimes abbreviated, and sometimes wanting. Posterior wings with an angulated projection on the anterior margin; the branch or discoidal veins usually wanting, leaving but the single rib-vein. Always oviparous, the agamic females never producing living larvæ. Most of the species form galls on plants, usually trees, selecting the leaves; some also attack the roots of the plants on which they form galls.

The young larvæ have the tarsi, but one-jointed.

This genus, like the rest of the sub-family to which it belongs, is without honey-tubes.

PHYLLOXERA VITIFOLIAE, Fitch. The Grape Phylloxera.

Syn. *Pemphigus vitifoliæ.* Fitch.
Byrsocrypta vitifoliæ. Walsh.
Phylloxera vastatrix. Planch.
Rhizaphis vastatrix. Planch.
Peritymbia vitisana West.
Dactylospherá vitifoliæ. Shimer.

This is the too well known species which has done so much damage of recent years to the vineyards, both of this country and Europe. I have retained the specific name *vitifoliæ* given by Dr. Fitch as it has undisputed precedence in date, and there can be no valid reason urged why it should be discarded for a more recent one. That it ought to have been written *vitifolii* or vitis-folii, may be true, but names with the termination *foliæ* have been too long received for this to be a valid objection in this case. If the law of priority is to apply I cannot see why this case should be an exception, I have therefore restored the proper name which the future, in justice to our noted American Entomologist Dr. Fitch, will adopt in spite of present usage of *vastatrix*.

This species has been so thoroughly written up in this country by Prof. Riley and Dr. Shimer that it is unnecessary for me to add any thing farther here than a brief description of the species and its gall, and the conclusion reached as to the best remedy.

This species produces numerous rough galls on the underside of grape leaves, opening on the upper side of the leaf. The gall is usually in the form of a roughened wart, without pedicel, green, but sometimes tinged with red or roseate; the minute opening on the upper side of the leaf is marked by a branch of minute hairs. The inside is clean, or free from any powdery substance. They vary in size, the largest being about the size of a pea: they are often so numerous as to cover the under surface of the leaf.

The winged female is of a light yellow; the thorax sometimes marked with a dark band; wings hyaline; the two discoidal veins uniting so that the second appears as a branch of the first; the third (or stigmatic vein) sometimes distinct and sometimes sub-obsolete, in some of the forms of this polymorphic species it unites at base with the other two.

Apterous individual, light yellow, convex.

Length of the winged to the tip of wings about .07 inch; the wings about twice the length of the body.

For a more complete account of this species, its history, habits etc., the reader is referred to works of Professor Riley, Dr. Shimer and Mr. Walsh. As I have nothing new to add, it is unnecessary that I should introduce here what is so generally known.

The following *resume* of the results of the experiments tried under the supervision of the Academy of Sciences, of France, upon this species is copied from *Nature*, No. 375, January 4, 1877.

"Some time ago we published in our columns a short account of the result of the investigations of various scientific men in France into the nature of the Phylloxera—that terrible scourge which is committing such wide-spread ravages among the French vineyards.

"Laterally we have received some reports, communicated to the French Academy of Sciences, dealing with the attempts which have been made during the last three or four years to arrest the mischief done by the insect, and ultimately to destroy it altogether, by means of some potent drug. It is obvious that the remedy to be employed must possess two qualities at starting, viz: It must destroy the insect, and it must not damage, to any great extent, the vine. But, further, it is not sufficient that when put in close contact with the roots of a plant—as in a pot—it should prove fatal to the insect; it is necessary, if the remedy is to be of real practical value, that it should reach and destroy the Phylloxera on all the parts attacked by it in vines which are planted out in the open air. This is a real difficulty to overcome, as the remedy, be it in the form of solution or of vapor, cannot easily permeate the soil, sometimes clayey, sometimes sandy, on which the vine is growing, so as to reach and act upon the smaller root branches, whose nutrition the Phylloxera diverts into itself.

"M. Mouillefert, a professor at the School of Agricultural at Grignon, was the gentleman delegated by the Academy of Science to make the necessary experiments for the purpose of determining what agent was the most practically applicable to the destruction of the Phylloxera; and the account of the numerous substances employed by him, with varying results, fills no less than two-hundred pages of a memorial presented to the Academy of Sciences. It is not our intention here to give more than a brief *resume* of the results at which he arrived.

"He divides the substances used by him into seven groups, the first of which was composed of manures of various kinds such as guano, super-phosphates, farm muck, etc; the second of neutral substances, as water, soot and sand; the third of alkalies, as ammonia and soda; the fourth, of saline products, among which were the sulphates of iron, copper, zinc, potassium and ammonia, alum and sea salt; the fifth of vegetable essences and products, as decoctions of hemp, datura, absinthe, valerian and tobacco; the sixth, of empyreumatic products; and the seventh of sulphur compounds. It was with some of the substances contained in this last group that really satisfactory results were obtained; and it is to M. Dumas, the Permanent Secretary of the French Academy of Sciences, that the credit is due for suggesting the employment of the alkaline sulpho-carbonates of potassium and sodium, and those of barium. All the other classes of remedies mentioned above were either without effect on the Phylloxera, or in destroying it, also destroyed or damaged the vine.

"The sulpho-carbonates, which were carefully studied by the great Sweedish chemist, Berzelius, are obtained by combining the alkaline monosulphides with the bi-sulphide of carbon, are either liquid or solid, and emit a powerful odor of sulphuretted hydrogen and bisulphide of carbon."

"The alkaline sulpho-carbonates, in the solid state, are of beautiful reddish yellow color and deliquescent, but are not easily obtainable in that condition; the sulpho-carbonate of barium can be easily produced, however, in a solid state, and presents the appearance of a yellow powder, but little soluble in water. The sulpho-carbonates decompose under the influence of carbonic acid, forming a carbonate, and evolving sulphuretted hydrogen and bi-sulphide of carbon. These two latter substances are gradually liberated, and as they have a very powerful effect on the Phylloxera, one can understand that the sulpho-carbonate, place in the ground, may prove, by its slow decomposition, a powerful insecticide.

In the case of the sulpho-carbonate of potassium, over and above its toxic effect, it has a direct invigorating influence upon the vine, as the corbonate of potassium is an excellent manure.

"The employment of the sulpho-corbonates as a means for the destruction of the Phylloxera was suggested to M. Dumas by the clearly recognized need that there was for some substance that would evaporate less quickly than the bisulphide of carbon; he saw that it was necessary to apply the insecticides in some combination which would fix them and only allow them to evaporate gradually, so that their action might continue long enough in any one place to infect with their vapors all the surrounding soil.

"But the task of eradicating the Phylloxera has by no means been accomplished by the mere discovery of the value for the purpose of these substances; there is the further difficulty of applying them to the vine in cultivation. One thing seems very certain, that in order to render the sulpho-carbonates available they should be reduced to a powder and spread over the ground before the heavy rains, that is between October and March, which will probably prove very efficacious.

"The conclusion as M. Mouillfert arrives at the end of the report, is that the efficiency of the sulpho-carbonates is proved, and all that is necessary is to bring to perfection their employment in agriculture, which can only be accomplished by the intelligence and practical knowledge of the vine-grower, who is well able to discover the economic processes of culture which are conducive to their successful ap plication.

"He ends by saying that science has accomplished its mission, and it remains for Agriculture to fulfill its part in the eradiction of the Phylloxera from the vineyards of France."

Notwithstanding the confidence here expressed by the distinguished scientists who conducted these experiments, subsequent facts indicate that the problem is really no nearer solution practically now than before these experiments were tried, except that the list of negatives is increased.

The disease appears to be spreading in Europe and no more under control now than before.

The true solution, so far as France is concerned I think will never be found in topical applications, but in an entire revolution in the horticulture of the vine growing districts. In other words an entire destruction of the veins and the adoption of some other culture for a number of years.

PHYLLOXERA CARYÆCAULIS. Fitch.

Syn. *Pemphigus caryœcaulis.* Hickory Gall Aphis.

Wingless females, of which one is found in each gall, she being the parent of the multitude of larvæ around her, measures 0.04 in length, or somewhat more. She is of a plump egg shaped form, narrower posteriorly and flattened on the under side. The segments of the abdomen are much longer than those of the thorax, and are separated by impressed lines. The legs are short, scarcely projecting beyond the outer margin, and with the antennæ are blackish, the general color of the body being yellow, often of a dull or dirty tinge.

The *larvæ* which occur in walnut galls are of different sizes, the largest being 0.025 long, of an oval form and a light yellow or yellowish green color, with dusky legs and antennæ. Younger individuals are white, shining and somewhat hyaline, with pellucid white legs. The antennæ are short and robust, consisting of two short, thick basal joints and a longer terminal one of a conical form, and giving off a short bristle on one side near the tip. The legs are also short and thick.

The *galls* are globular in form and of different sizes, from that of a pea to an ounce ball, and are attached to the side of the stem the whole length of their base, often causing a bend or distortion of the stem, especially when two or three are contiguous and confluent, as they frequently are. The walls of the gall are about the tenth of an inch in thickness, and of a succulent, fleshy texture, white upon the inside and green on the outside at first, but soon becoming discolored with black, which spreads until the whole is of this color. The hollow inside has its surface covered with minute smooth shining lice of different ages and sizes, so that it resembles the geode of a mineral, the surface of which is lined with a multitude of minute crystals, whose sparkling points are everywhere glittering in the light. Numerous dusky specks are also observed among the lice. These are the cast skins of the lice, all of which moult as they increase in size, their original skins becoming too small to contain them, and being of too firm a texture to expand with the growth of the insect. (Fitch).

PHYLLOXERA CARYÆFOLIÆ. Fitch. Hickory-leaf Witherer.

Forming small conical elevations on the upper surface of the leaf, each having an orifice in its summit; a very small black plant louse with a pale abdomen and legs and smoky wings laid flat upon its back, and having only three veins in addition to the rib. Length 0.06.

The winged lice may be found wandering about upon the surface of the leaf, having escaped through a small orifice at the apex of the gall; the young are found crowded together inside the gall covering the walls of the cavity, they are of a pale yellow color with only a dusky band between the bases of their wings. As soon as they leave the gall they change to a black color, the abdomen only remaining pale yellow often tinged with green. Their legs are short and pale with black knees and feet. The antennæ are short thick and thread-like, scarcely longer than the head, and with but three or four joints difficult to discern.

The wings are placed horizontally upon the back and not elevated as in most of the plant-lice. They are smoky-transparent with a more dusky spot or stigma on the outer margin between the tip of the rib-vein and the outer edge, the rib-vein being perfectly straight and not curved as in the other plant lice to give a greater width to this stigma spot. In addition to the rib-vein the fore wings have only three oblique veins, all of which are straight and black. The first of these is placed forward of the middle of the wing and runs from the rib-vein to the inner margin. The last one runs from the stigma to the tip of the wing and is abortive or imperceptible at its base where it starts from the stigma. The middle vein is parallel with this last and starts from the first vein above its middle and reaches the inner margin equidistant from the tips of the other two, its base being abortive for a short distance. The hind wings form a very conpicious angular point on the middle of their outer margin and have a longitudinal rib-vein but are wholly destitute of any oblique vein running from it to the inner margin. (Fitch).

Found on the leaves of the shag-bark hickory (*Carya alba*).

Phylloxera caryævenæ. Fitch.

Syn. *Pemphigus caryævenæ*. Fitch. Hickory-vein Gall-louse.

Forming plaits in the veins of the leaves, which project up from the surface in an abruptly elevated keel-like ridge upon the upper side of the leaf and with a mouth opening on the under side, the lips of which are woolly and closed.

Although the aphis which produces these plaits in veins of the leaves is unknown to us in its winged state, its work will suffice to distinguish it from other species. The plaits occur mostly near the middle of the leaf, upon one side of the mid-vein occupying the bases of the lateral veins, two or three of which are commonly enlarged into the excrescences or galls, which put up in keel-like ridges from a quarter to a half inch in length. These ridges are of a pale yellow color, turning brown and becoming dry and dead after a time, frequently before they perish the portion of the leaf between them withers and turns brown, in which case the inhabitants of the gall forsake it, being no longer able to obtain a due supply of nourishment from its walls. The lips of the mouth which opens on the under side of the leaf are covered with white or pale tawny yellow wool. They are pressed together, but a small orifice is open at their outer end through which some of the young lice frequently crawl from the interior of the gall and station themselves upon the under surface of the leaf by the side of the mid vein. The lips are readily drawn apart, exposing the cavity within, the walls of which are covered with minute wingless, females and their eggs and young. The females are egg-shaped, broadest anteriorly and tapering behind to an acute but not an attenuated point. They are 0.03 long, 0.02 broad, very pale yellow and at the tip watery white. The eyes appear like two minute brown dots widely separated, the head being short and broad with the transverse sutures between it and the other segments of the body very slight and indistinct. The legs and antennæ are short,and tinged with dusky the antennæ are three-jointed, the basal joint thickest and about as broad as long, the second joint globular and the third elongated and cylindrical, with a projecting point upon one side at the tip. When moving about, the antennæ appear to be employed as a fourth pair of legs, their points being pressed to the surface over which it is passing similar to the feet. The eggs are small oval shining grains of a watery yellowish white color. The young larvæ are intermediate in size between the eggs and the females, and resemble the latter except that they are of an oval form and their beaks are proportionally longer reaching to or slightly beyond the tips of their bodies.

These excrescences are common upon hickory leaves throughout the summer season.

PHYLLOXERA CARYÆ-GLOBOSA. Shimer.

Syn. *Dactylosphæra globosum.* Shimer.

Winged female—Abdomen and prothorax orange yellow; mesothorax, head and eyes blackish; legs and antennæ dark cinereous. Wings hyaline, broad, somewhat overlapping as they lie horizontally on the back. Anterior wing evenly rounded on the posterior margin; anterior margin rather straight, somewhat curved, convex at the middle of the stigma, apex quite broadly rounded, the wide wedge shaped base not extending beyond the middle; stigmatic nervure nearly straight, terminating in the center of the apex, not visible at either end. The discoidal within the middle of the wing not visible at its outer end, somewhat convex anteriorly, its branch hyaline at its extremities; stigma honey-yellow, darkest on the costal margin, the apical end lanceolate; inwardly extending to the base of the wing, all the costal space being of the same color. Posterior wing, one longitudinal vein and no discoidal, Tibiæ and tarsi with a few scattering hairs; claws palish horn-colored, with blackish tips. Length to tip of wings .07 inch; body about .025 inch long.

Wingless female—much resembling the grape leaf louse, *Phylloxera vitifoliae*, but smaller, the dull, pointed promuscis blackish at the extremity.

The following list of these species of this genus is from Prof. Riley's Seventh Report.

PHYLLOXERA RILEYI Licht. The Oak-leaf Phylloxera,

Living on the under side of the leaves and hibernating on the stems of the white, swamp-white and iron oaks, (*Quercus alba*, *bicolor* and *obtusiloba*).

P. caryae-semen, Walsh.

Forming fuscous, minute, sub-globular, seed-like galls on the upper side of the leaves of the pignut hickory (*Carya glabra*) which open in a small nipple on the underside.

P. caryæ-globuli, Walsh.

Forming hemispherical galls, about the fourth of an inch in diameter on the upper surface of the leaves of *Carya glabra* and *alba*; the galls rather flat below, where they open with a slit.

P. spinosa, Shimer.

Forming large, irregular galls, covered with spines, on the petioles of the leaves of *carya amara* (bitternut hickory), the galls opening beneath with an irregular sinuate slit.

P. caryae-septa Shimer.

Forming flattened galls with a septum, on the leaves of *carya alba*, which open both above and below.

P. forcata, Shimer.

Forming galls similar to those formed by *P. caryae semen*, but larger.

P. depressa, Shimer.

Forming depressed galls on the leaves of *carya alba*, which open below with a restricted mouth fringed with filaments.

P. cornica, Shimer.

Forming galls similar to the last, but without fringe.

P. caryæ-gummosa, Riley.

Forming pedunculated, ovoid or globular galls on the under side of the leaves of the *carya alba*; the gall white pubecent and gummy or sticky, opening below in a fibrous point.

P. caryæ-ren, Riley.

Forming numerous more or less confluent, mostly reniform galls on the petiole of *carya alba*; green, densely pubescent and opening with a slit the whole of their length and transversely to the axis of the petiole.

P. caryæ-fallax, Walsh.

Forming conical galls thickly crowded on the upper surface of the leaves of *carya alba*. Strongly resembling *P. caryæfoliæ*, but the height one-third greater than the basal diameter, and opening below instead of above, in a circular, fuzzy mouth.

P. castaneae. Hald.

This is the *Chermes castaneae* of Haldemann, which Riley says is undoubtedly a Phylloxera; although I have not seen the description, I presume, from the name, that it infests the chestnut.

SUB-FAMILY. RHIZOBINÆ.

This sub-family as here arranged is necessarily artificial as it is based chiefly on the supposed permanently wingless condition of the species, and their habit of residing in the ground and feeding on the roots of plants. But it is more than probable that when the life history of the species is traced, it will be found that many of them produce winged individuals. In fact it may ultimately be found that no species is permanently apterous.

So far but few species of this group have been determined in this country, and these have been assigned to two genera, *Rhizobius* and *Tychea*, but the characters by which the genera and species are distinguished are so slight and uncertain that no great reliance is to be placed upon them except where the species have been observed with sufficient care to ascertain positively the adult state, and the habits.

So far as my observations have extended the species, do not appear to be confined so rigidly to a given species or genus of plants as is the case with aerial species. This fact also adds to the difficulty of determining species.

GENUS RHIZOBIUS. Burm.

As I have no means of access at present to the original diagnosis of this genus by Burmiester I can only define it from the statements of others and from the species assigned to it. The characters by which it is distinguished by recent authors are as follows:

Species apterous, at least so far known; subterranean, residing only on the roots of plants. Antennæ very short, and according to Passerini six-jointed, according to Fitch, five (?) or six-jointed; but a species described below which I am pretty well satisfied belongs to this genus has these organs apparently seven-jointed, but the division between the third and fourth is not distinct; the joints are sub-equal, the third not obviously longer than the fourth, each short, the last usually the longest and thickest. Honey-tubes wanting. Tarsi with but a single claw, in the species so far described.

Dr. Fitch states that the species are always viviparous and never oviparous, an assertion which cannot be accepted as correct without further proof.

RHIZOBIUS LACTUCÆ. Fitch. Lettuce Earth-louse.

The *young lice* measure 0.02 in length, are very pale yellow, glossy and watery, with the legs and antennæ whitish. They are nearly thrice as long as broad, somewhat flattened, their opposite sides parallel in some, in others slightly widening backward and rounded at the tip. The transverse sutures are faintly perceptible. The eyes appear as minute black dots, one on each side of the anterior end. The antennæ are thread-like, and only one-fourth the length of the body. When highly magnified, they appear to be four jointed, the joints twice as long as thick, the first joint cylindrical, the two following ones thicker toward their tips, and the last one slightly longer than the others, and thickest toward its base. The feet are but one-jointed, half as long as the shanks, and end in a pair of hooks.

The *mature lice* are ·0.08 long, their width less than half their length, some being much broader than others. They are oval, and of a dull white color, with the legs, antennæ and beak dusky, sometimes pale smoky with their bases nearly white, and in other specimens much darker and even blackish their entire length, with the end of the body also slightly. The beak is appressed to the breast appearing like a short dusky mark upon the skin, its tip scarcely reaching the base of the second pair of legs. The antennæ are shorter and more slender than the fore legs, thread-like and five-jointed, the joints cylindrical. The two basal joints are slightly thicker than the following ones, and their length double their thickness. The third joint is variable in its length, in the mature females being almost double the length of the second, and but little shorter than the last joint, whilst in the narrower younger lice it is little, if at all, longer than the second. The fourth joint is the shortest of all, being but little longer than thick. The last joint is longest, and is bluntly rounded at its end. The sutures of the body are marked by slender impressed transverse lines. The feet show but one distinct joint, which is cylindrical, and four times as long as thick in the hind pair, shorter in the middle and anterior pair, with two hooks at the end.

On the roots of lettuce, often in great numbers; very small oval, white and pale-yellow lice, with dusky legs and antennæ, their bodies dusted over with a white powder.

RHIZOBIUS POÆ. n. sp.

This singular species is placed in *Rhizobius*, although in some respects it differs from this genus as understood by Passerini.

Wingless viviparouz female.—Size small, the length about .05 inch, width at widest point about two thirds the length; reguarlarly elliptical in outline, very convex, a cross section at any point presenting almost a circle; covered with a blueish white powder, but when this is removed, of a reddish brown, or brownish flesh color. Legs very small and very short, the pairs rather distinct from each other; the tarsi apparently but one jointed when examined carefully under a strong power. Antennæ apparently seven-jointed, very short, and not tapering, the last joint being as thick as the preceding and maintaining this thickness to its tip; first joint very thick, its length about equal to its diameter; second joint about the same length or very slightly longer, diameter not more than half that of the first and not exceeding that of the remaining joints; third joint shortest, not more than half the length of the second; fourth, fifth and sixth about equal in length, each shorter than the second and longer than the third; seventh longest, equal in length to the fifth and sixth united; whole antennæ very slightly hairy, hairs minute and not more than one or two a joint except the last which has a scattering whorl about the tip, What are here counted as third and fourth joints may in reality form together the third joint, as the suture is not distinct in any specimen, under a high power.

The body, when the powder is removed, appears to be quite smooth; a large spine-like hair extends back-ward from each side of the tip of the abdomen.

I have been puzzled to make out the beak, which is evidently very small and apparently pressed into a kind of groove or depression on the breast. The eyes have not been distinctly made out, though a slight tubercle has been observed in the place of each.

The head can scarcely be distinguished; the annulations are very distinct and regular.

The antennæ and tarsal characters if allowed to prevail, would appear to place this species in *Trama*, but the third joint of the antennæ is shorter than the others which conflicts with the character of that genus in this respect. The form and habits are like those of *Tychea.* It is also evidently very closely allied to *Rhizobius sonchi* Pass., which is found on the roots of *Sonchus oleracea* and other allied plants and is described by Passerini as follows:

"Powdered with white; elliptical oblong, distinctly annulate. Antennæ very short, pilose, first five articles ovoid subequal, last subclavate and longer than the preceding. Legs very short; tarsi terminated by a single claw."

Found at Cardondale, Illinois, in November, on the roots of grass, apparently *Poa annua.*

Genus TYCHEA. Koch.

The general form is broadly oval and quite convex; the segments distinctly marked, those of the throax similar in appearance to the others. Beak rather long, and thick. Antennæ very short five-jointed according to Passerini and six-jointed according to Koch, but it is probable that the former author omits the little spur at the tip of the fifth joint which is usually present, while the latter counts it; the third joint longest usually equal to the fourth and fifth. Honey-tubes wanting.

The species so far as known are wingless and reside on the roots of plants.

TYCHEA ERIGERONENSIS. n. sp.

A short time ago I received from Prof. T. J. Burrill of the Industrial University a very neat drawing accompanied by notes, and some specimens of a wingless plant-louse found on the roots of Endive and *Erigeron canadense*, which as will be seen by his notes, copied below, he susposed would fall in the genus *Trama.*

I am in considerable doubt as to the proper position of the species, but for reasons given below I am inclined for the present to place it in *Tychea* of Koch, as it is excluded from *Trama*, as limited by Passerini, by the tarsal character.

Wingless specimens (the only kind observed).—Antennæ apparently only five jointed unless the little spur at the end be considered a sixth joint; third joint slightly the longest and about equal in length to the first and second; fourth about three-fourths the length of the third; fifth slightly longer than the fourth, and appears to have a spur or rudiment of a sixth joint at the tip. Eyes not apparent, but the position occupied by a small, white, granulated protuberance. Beak long and stout, reaching slightly beyond the base of the posterior legs; the penultimate joint about two-thirds the length of the last joint, and broad. Body very regularly ovate, and very convex; smooth, without hairs, bristles or down of any kind, except a brush of short hairs at the tip of the tail. Apparently furnished with a short distinct, broad tail, but this may not be a true tail. The stomata are very distinct and brownish. No honey-tubes or signs of any, visible. The abdominal segments are very indistinctly marked, the ventral segments more distinct. The prothorax is rather narrow in front, and forms a very distinct offset with the mesothorax.

The general color is transparent white, varying to a pale cream color; antennæ dusky, and in some cases, even dark, almost black at the tips. Legs very short, femora and tibiæ pale, dirty white; tarsi fuscous. Size small.

Prof. Burrill, who is an excellent microscopist and close observing naturalist, furnishes the folowing memorandum in reference to them:

"CHAMPAIGN, ILLS., Oct. 25, 1878.

"Louse on the roots of Endive and *Erigeron canadense*, in the garden. They were noticed last year upon the former, and occasionally throughout the last summer, on both. Numerous, usually in clusters of many individuals of various sizes, No winged forms observed. All white, the apical joint of the beak, a little darkened; the feet and antennæ somewhat bluish or brownish; eyes dark and very small. Feet with two joints, the last very short and terminated with a pair of claws. Antennæ five-jointed, the third longest. Nine abdominal segments, each furnished with a (very small) tubercle on each side, and four dorsal ones, making four lines down the back, the inner ones of the first, second and third segments run together; two rows on the head and thorax. The lice are attended by a medium sized yellow ant, which seems to be very solicitous for their safety, taking them in their mouths and carrying them away when disturbed, and dying when separated from them. This louse is no doubt *Trama radicis*, mentioned by Harris. The body is plump and rounded when full, but after a short time, when not supplied with food, becomes shrunken, and a distinct lateral ridge is found."

The specimens sent me, taken from the two plants mentioned, were mixed before the Professor's letter was received, supposing them to be the same, which appears to be his opinion; but a full and careful examination has satisfied me that there are either two varieties or two species embraced. The one described is quite smooth, without hairs or bristles, except the brush of hair at the end of the broad tail; what Prof. Burrill supposed to be tubercles, were not seen by me in the specimens received, but little bubbles, regularly spaced along the side and which apparently proceeded from the stomata, were seen in one specimen; none were observed along the back. Another specimen was noticed, which had the antennæ distinctly hairy, the tips of the outer joints having almost complete whirls of scattering hairs at the tips; this specimen also presented some other characters slightly differing from those described; and hence I have been led to the opinion the latter belong to different species.

But the most important question connected with the history of these insects, at least most important to our agriculturalists, is this; are these wingless, root inhabiting insects, the ultimate and permanent form of the species? There are some reasons which induce me to believe that they are dimorphic, and that this subterranean character is but one of the forms they assume, and is probably a means provided by nature of passing through the winter or other portion of the year, during which the particular plants they inhabit furnish them no means of subsistence.

One is, that very few of these subterranean species have been carefully studied; but where this has been undertaken and carried out a large per cent. of these few have been traced to the winged form. Another evidently is that all these specimens have a larval appearance; the antennæ are not fully developed; several of them showing beyond a doubt that the spur at the end of the fifth joint was growing into another joint of the form found only in those species with seven jointed antennæ; and in these cases the third showed a constriction indicating a division into two joints, which is a very common method of development in this family. I am satisfied therefore that this species should be included under a genus with six or seven-jointed antennæ. And although placed with those considered as permanently wingless, as indicated by the characters yet for reasons more fully set forth in the introductory part of this report, I am pretty well satisfied that it will ultimately be found that these are dimorphic forms of winged species.

TYCHEA PANICI. Thos.

(See figure 31, at end of report).

Antennæ very short, in the specimens examined, which appear to be scarcely full grown; not reaching beyond the prothorax, apparently five-jointed; joints nearly equal to each other, sub-moniliform. Body ovate, very convex. Apparently without eyes, at least I failed to find them with a pretty high power, yet Mr. Pergande appears to have found specimens in which they were minutely represented, as shown in the figure drawn by him. Beak very short, reaching but little beyond the first coxæ. Legs unusually short, the hind pair being scarcely longer than the others. Without honey-tubes or anything representing them. Divisions between the segments not well marked. Uniform orange red or reddish-yellow; beak tipped with fuscous. Length not more than about .04 of an inch.

Found during October, by Mr. T. H. Pergande, at St. Louis Mo., on the roots of *Panicum glabrum*.

This is probably a species of *Tychea*, which has, according to Koch, six-jointed antennæ, but according to Passerini, only five.

SPECIES OF UNCERTAIN POSITION.

The following species described by Dr. Fitch have been placed in *Callipterus*, but as he asserts that the wings lie flat in repose they cannot belong to that genus. As I am unacquainted with them I have not attempted to assign them to their proper position.

Aphis caryella. Fitch.
Callipterus caryellus. Fitch.

Pale yellow with white antennæ which are alternated with black rings, the wings transparent and without spots, their veins slender and pale yellow, the legs yellowish white to their ends. Length 0.12 to the tips of the wings. The abdomen is depressed, egg-shaped, its apex slightly narrowed and elongated. The antennæ are longer than the body, tapering, seven jointed; two basal joints as broad as long, twice the diameter of the following joints, third joint longest, slightly thicker towards its base; fourth and fifth joints rather shorter than the third, cylindric, two last joints together about equaling the fifth in length, the sixth swelled at its tip into a long oval knob, the seventh more slender but not capillary, shorter than the sixth; a broad black band at the apex of the third and each of the three following joints. First vein of the fore wings straight and almost transverse, second vein bent near its base; running first towards the apex and then turning rather abruptly and continuing straight to the inner margin; more than twice as far from the first at tip as at base, third vein arising from the stigma near its anterior end; and not from the rib-vein forward of the stigma, as it does in the aphides generally, except those petaining to this group, its base and its apex about the same distance from the second vein that it is from the first, forking rather forward of its middle; strongly bent at this point; and from hence to its tip parallel with the third vein or but slightly diverging from it; its tip a third nearer that of the third vein than this is to the second; second fork nearer the fourth vein at tip than to the first fork, the triangular cell between it and the first fork with its three sides equal; fourth vein short and often nearly abortive, shorter than the second fork, equally curved through its whole length, its tip much nearer that of the rib-vein than that of the second fork; rib-vein very slightly diverging from the margin, from the base to the stigma, curved from thence to its tip. Stigma oval, about twice as long as wide, watery, sometimes tinged with yellowish. A variety has the stigma dusky at its tip. Another variety (*costalis*) has the rib-vein coal black interrupted with whitish towards the stigma, which is dusky and black at each end. On the leaves of hickory.

Aphis punctatella. Fitch.
Callipterus punctatellus. Fitch.

This is much like the preceding in the color of its body, antennæ and wings, but has black feet and a black dot on the base and another on the apex of each of the veins of the fore wings; the stigma is salt white with a brown streak at each end; the second vein is wavy and at its tip is curved towards the tip of the first vein; the third vein arises from the basal extremity of the stigma and forward of its furcation curves perceptibly towards the apex of the wing; the fourth vein is longer than the second fork.

Aphis maculella. Fitch.
Callipterus maculellus. Fitch.

Differs from the *caryella* in having only a slender black ring at each articulation of the antennæ, the feet and a band near the tips of the hind thighs blackish, the stigma salt white, its base black, its apex dusky; fourth vein with a black dot on its base and a dusky one on its apex; the first vein, apical third of the second vein, and the fiist and second forks broadly margined with smoky brown; second vein wavy and parallel with the third vein till near its tip where it curves towards the first vein, its base a third nearer the third than it is to the first vein; third vein arising from the anterior extremity of the stigma, with a dusky spot on its apex.

Aphis fumipennella. Fitch.
Callipterus fumipennellus. Fitch.

This is of a dull yellow color with blackish feet and the wings smoky with robust brown veins, the rib-vein much more distant from the margin the first half of its length than in the other species, and from its middle to the stegma approaching the margin, the fourth vein, equaling the stigma in length.

Aphis marginella. Fitch.
Callipterus marginellus. Fitch.

Pale yellow, antennæ white, their bases and the four bands black; a coal black band in front between the eyes and continued along each side of the thorax to its base; elitra pellucid, stigma, outer margin and rib-vein coal black, first vein with a black dot on its base; fourth vein slender, black, the other veins colorless; outer margin of hind wings black.

CALLIPTERUS MUCIDUS. Fitch. The Mouldy Aphis.

A solitary plant louse, walking on the leaves or hovering on the wing in their shade, having its body, legs and antennæ coated over more or less, with pruinose matter resembling fine bluish-white mould. Pale green whitish anteriorly, legs and antennæ black, their bases pale; wings clear and glassey with a small dusky or black cloud on the tips of the veins; the rib-vein whitish to the stigma, and from thence thicker and coal black. Length 0.075.

INSECT ENEMIES AND PARASITES.

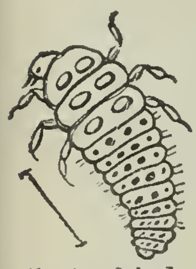
There is parhaps no other group of insects in the entire class that has as many natural and inveterate foes, as that which includes the true Plant-lice. These species appear to be designed by nature to extract the sap of plants and fit it for the nourishment of other insects. Living entirely upon the sap of the leaf, twig or stem on which they are deposited, and having little occasion for exercise or movements, and led by instinct to avoid as for as possible the direct rays of the sun, their external envelope or dermal covering, in fact all parts of the body, remain soft and tender, and their rapid imbibation not only constantly keeps them filled with fluids, but is so great in proportion to their capacity that nature has provided them with nectaries or honey-tubes as escape valves for the overplus. They are therefore most dainty food for the rapacious insect appetite, and their enemies are numbered by scores; in fact nature seems to have prepared entire families of insects as a special means of keeping them in check, and without which vegetation would soon, in a great measure, succumb beneath their attacks.

These enemies are found in the Orders *Coleoptera* (beetles), *Neuroptera* (lace-wing flies, etc.), *Hymenoptera* (bees, wasps and wasp-like insects), and *Diptera* (flies and gnats).

Their beetle foes (*Coleoptera*) are confined chiefly to the *Coccinellidæ*, or lady-bird family. These beautiful little beetles, so well known to everyone by their hemispherical shape, and bright red or yellow color with black dots, or black color, with red or yellow dots, are most inveterate Aphis eaters, both in their larval and perfect states. Their, eggs, which are smooth, oval and usually a bright yellow color, may frequently be met with on the under surface of leaves, in clusters of from two to three dozen, placed close together, and gummed by one end to the leaf.

These hatch in a few days, producing usually small blackish larvæ, which are somewhat elongate in form, and narrowed posteriorly, and possess six legs situated on the three anterior segments. As they grow they gradually assume the colors indicative of their specific differences and they also develop on the sides, and in some species over the back, rows of tubercles or spines. (See fig. 32, a., 34 and 39). When they have completed their growth, they shorten their length, the back becoming more convex; and fixing themselves by the tail to the bark, twig or leaf, enter the pupa or chrysalis state, from which in a short time the lady-bird is developed. These larvæ, from the time they issue from the egg until they have completed their growth, feed upon plant-lice or other tender insects, the former being their favorite and usual food. Some species prey chiefly upon the bark-lice. Nor do their carniverous propensities cease with the close of their larva state, but continue in the perfect state also. Half a dozen of these will clean a currant or rose-bush of lice in three or four days. I have seen a large rosebush badly infested with lice, cleared of them in two days by four spotted lady-birds (*Hippodamia maculata*) which the owner placed on it at my suggestion.

Fig. 32.

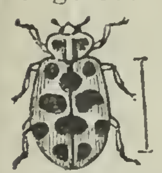


Lady-bird larva.

The following species of this family may be mentioned as those most common in Illinois.

Hippodamia (Megilla) maculata. De G. The Spotted Lady-bird.

Fig. 33.



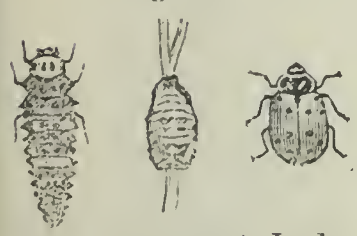
The spotted Lady-bird.

Is oval in form, of a brick red color, with two black spots on the thorax, and ten on the wing covers. The latter are arranged four on each side and two on the center or middle line where the two wing-cases meet.

Is a general feeder, destroying eggs of various insects, and eating plant-lice, chinch bugs, etc. Very common throughout the State.

Hippodamia convergens, Guer. The Convergent Lady-bird.

Fig. 34.

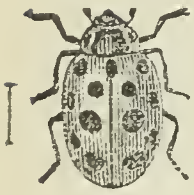


The convergent Lady-bird, larva and pupa.

A little smaller than the preceding, and broadly oval in shape; orange or orange-red; thorax black, with two oblique white dashes; five black dots on each wing case, placed 2, 2 and 1, the anterior two the smallest, all less in size than those of *H. maculata*.

HIPPODAMIA 13-PUNCTATA, Herbst. The 13-Spotted Lady-bird.

Fig. 35.



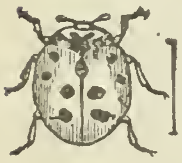
Rather smaller than *H. convergens*, but similar in form; of a brick-red color, with six black spots on each wing-case, and one on the suture near the front.

HIPPODAMIA GLACIALIS, Fabr. Ice Lady-bird.

Similar in form and size to *H. maculata*; of a bright orange-red color; thorax black, with two oblique yellow dashes; each wing-case marked with a double black spot just behind the middle, and a single black spot near the tip. A northern species.

COCCINELLA 9-NOTATA, Herbst. The 9-spotted Lady-bird.

Fig. 36.

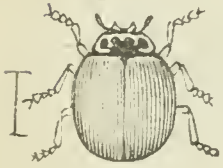


9-spotted Lady-bird.

About the same length as *H. maculata*, but hemispherical in form, varying in color from orange to a brick-red; with for black spots on each wing-case and one on the suture near the front.

COCCINELLA MUNDA, Say. The Trim Lady-bird.

Fig 37.



Trim Lady-bird.

Is somewhat smaller than the preceding species; hemispherical; of a clay-yellow or dull orange color, without spots or marks of any kind on the wing-cases.

CHILOCHORUS BIVULNERUS, Muls. Twice-stabbed Lady-bird.

Fig. 38.

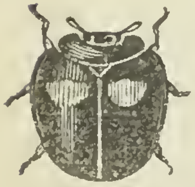
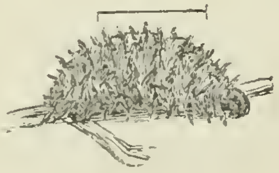


Fig. 39.



Twice-stabbed Lady-bird and larva.

Orbicular; black, with a red spot on each wing-cover.

ANATIS 15-PUNCTATA, Oliv. The 15-spotted Lady-bird.

This is our largest species, being half an inch long; hemispherical in shape; the thorax is cream-colored, with a large black spot in the middle and usually a black dot each side; the wing cases chocolate color, with seven black dots on each and one on the sutures near the front; but it varies considerably, and some of the dot are sometimes wanting.

Among the Hymenopterous insects which assist in destroying plant-lice, none perhaps are more affective than certain very minute *Ichneumon* flies, which have received the name *Aphidides* from the fact that they are parasitic upon the *Aphides* or plant-lice.

These little insects, which seldom reach one-tenth part of an inch in length, are wasp-like in shape, furnished with four tiny wings with three cubital cells in the anterior ones; mostly black bodies, variously adorned with bright yellow bands and other marks; the second and third segments of the abdomen move freely upon each other. When one is about to deposit her eggs she approaches and touches a plant-louse with her long slender antennæ, and is enabled thereby to determine with certainty whether it has received an egg; if not, she at once punctures the body with her slender ovipositor and deposits an egg therein, and passes on to another to repeat the operation. This egg produces a minute grub or larva, which ultimately destroys the life of its victim, and comes forth a fly, similar to its parents.

The description of a few species will be sufficient to convey to the reader an idea of these useful insects, which is all that is necessary for present purpose.

APHIDIUS LACTUCAPHIS, Fitch. Lettuce-louse Aphidius.

Deep black, legs trimmed with brownish; antennæ 19-jointed, second joint smallest, globular, third joint longest, with a slight constriction in the middle; wings slightly smoky, outer marginal vein and vein bordering the cell beyond the stigma, black, outer veins brown, stigma white; abdomen long obovate, flattened, rather narrower than the thorax, tip rounded. Length, 0.06. inch.

The names given indicate the species of Aphis upon which these insects are known to be parasitic. But it is not probable they are confined to a particular species.

APHIDIUS (PRÁON) POLYGONAPHIS, Fitch. The Knot-weed-louse Aphidius.

Black and shining; abdomen slender elliptical, of a bright sulphur yellow color; tinged with dusky above and beneath the tip, with broad yellowish bands at the anterior sutures, base narrowed to a short pedicel, which, with the legs and base of the antennæ, are reddish-yellow; antennæ 17-jointed. Length 0.08 inch.

APHIDIUS (PRAON) VIBURNAPHIS. Fitch. Cranberry-louse. Aphidius.

Black and shining; similar to the preceding, but the abdominal pedicel and the legs only yellowish; antennæ 15-jointed.

APHIDIUS (PROAX) AVENAPHIS. Fitch. Grain-louse Aphidius.

Black; legs base of the abdomen and also a sub-basal band, yellow; abdomen as long as the thorax, but narrower, oval, first segment forming a pedicel; antennæ as long as the body, slender, 20-jointed, black, thorax egg-skaped, black and shining. Length, 0.10 inch. Parasitic on the oat or grain Aphis (*Aphis avenæ*).

TOXARES TRITICAPHIS. Fitch. Wheat-louse Aphidius.

Black, shining; antennæ, thread-like, longer than the body, and 25-jointed; thorax egg-shaped and rather broader than the head; abdomen flattened, long oval, a little longer than the thorax, but scarcely as broad. Wings transparent,slightly smoky, strongly iridescent; stigma pale brown; veins brownish black. Length 0.08 inch.

Parasitic on *Aphis avenæ*.

TRIOXYS SALICAPHIS. Fitch. Willow-louse Aphidius.

Black and shining, with a long elliptical abdomen of honey-yellow color at the base, but gradually passing to black posteriorly; legs, yellow; feet, dusky; antennæ two-thirds as long as the body, 13-jointed. Length, 0.06 to 0.07 inch.

TRIOXYS POPULAPHIS. Fitch. Poplar-louse Aphidius.

Black and shining, the abdomen long, elliptical and much narrower than the thorax, the basal suteres yellow; legs yellow except the posterior thighs, which are black; antennæ nearly as long as the body, 15-jointed; outer margin of the fore wings, blackish; stigma dusky. Length, 0.07 inch. Parasitic on an Aphis found on the leaves of the Balm of Gilead.

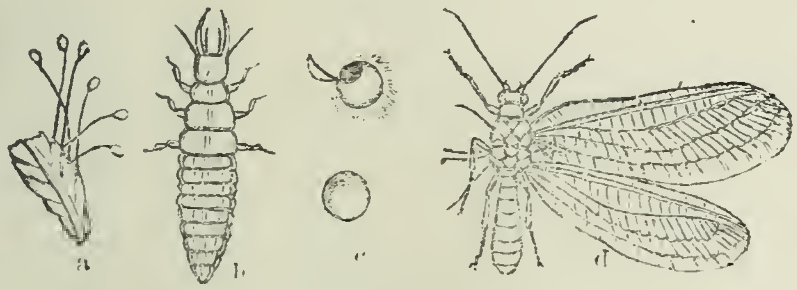
TRIOXYS CERASAPHIS. Fitch. The Cherry-louse Aphidius.

Black with the palpi and legs pale yellowish brown, antennæ almost as long as the body, 18-jointed; abdomen elliptical, rather narrower and shorter than the thorax, with scarcely any pedicel at its base, shining and tinged with brownish; wings pellucid; stigma, cloudy white. Length, 0.07 inch.

These as a matter of course, form but a small portion of the large number of species of this group of parasitic insects. Whether any species are limited in their operations to a particular aphis has not been yet satisfactorily ascertained; that some are parasitic on more than one species of aphis is true, but at the same time it may be true that certain plant lice may have their special parasites.

Another group of plant-lice destroyers is found in the order *Neuroptera*,which consists of the Dragon-flies, Ant-lions, Lacewinged-flies, etc,, Those are the lace-winged flies which have rather long, slender bodies, and four broad, spreading, thin membranous wings with numerous transverse veinlets. They are usually pale green, and when handled leave on the hands an unpleasant odor. The female suspends her little eggs on delicate threads, in clusters, on the under side of the leaves where the plant-lice abound.

Fig. 40.



Chrysopa—Eggs, Larva, Coocoon and Perfect insect.

a. The eggs mounted on their slender thread like stems. *b*. The larva with its long sharp, sword-like jaws. *c*. The singular small coocoons in which the pupa resides; one showing the opening and lid through which the insect has escaped. *d*. The perfect insect, showing the wings on the right side only.

The larvæ which hatch from these are somewhat spindle-shaped, narrowed in front, rounded behind, and broadest rather behind the middle, and furnished with large curved, sharp jaws, with which they seize and devour their helpless victims.

A description of two or three species known to inhabit Illinois, will be sufficient to give the reader an idea of these important aids.

They belong chiefly to the genus *Chrysopa.*

CHRYSOPA OCULATA, Say. The Eye-marked Golden-eye.

Greenish-yellow; antennæ yellowish, apex obscure, second joint annulated with black, first joint with a red dorsal spot and ring; head yellow, bases of the antennæ surrounded with black rings, a black point each side behind the eye, and four black points on the occiput; front thorax with three black points each side; wings hyaline, transverse veins of the front pair more or less black. Length to the tip of the wings six to seven-tenths of an inch; wings expanded measure rather more than one inch.

CHRYSOPA ILLEPIDA, Fitch. The Disagreeable Golden-eye.

Similar to and probably a variety of the preceding; has the four black points on the occiput united into two lines, and a part only of the transverse veins of the front wings black.

CHRYSOPA CHLOROPHANA, Fitch. The Yellow-headed Golden-eye.

Similar to the preceding, and probably a variety also of *C. oculata*. Pale yellowish-green, with a light yellow head; the wings more rounded at the apex, with the veinlets mostly green. Expands 1.10 inch.

CHYSOPA PLORIBUNDA, Fitch. The Weeping Golden-eye.

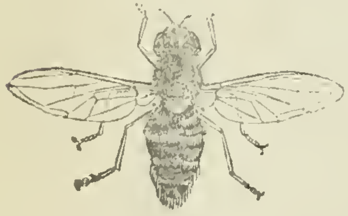
Very pale green, with a paler dorsal stripe along the body; head pale yellowish, with a small black line at the eyes; antennæ whitish, with the apex yellowish; legs greenish white, feet yellow. Sometimes there is a reddish or orange spot each side of the head. Expansion one inch.

Common in Illinois.

CHRYSOPA PSEUDOGRAPHA, Fitch. The Counterfeit Golden-eye.

Much like the last, but of a straw color without any tint of green; head brighter yellow, with a small black line each side of the face; antennæ, feet and veins of the wings, whitish; abdomen with a narrow white dorsal line and an apical yellowish spot on each side of each segment. Expansion one inch.

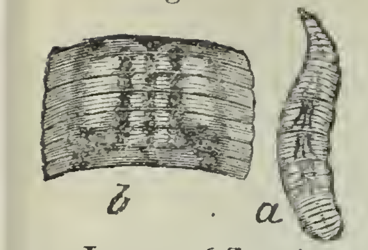
Fig 41.



Syrphus fly.

Although these and several others are given by Dr. Hagan and Dr. Fitch as distinct species, it is more than probable they are but varieties of one or two species; at least they have similar habits, and hence their distinction is a matter of but little consequence to the horticulturist. They are his friends and so far as possible, should be protected, and whenever he observes the eggs mounted on their little, transparent hairs, he should be careful to leave them uninjured, as the larvæ will soon destroy the plant-lice among which they are placed. Nor do they confine their attacks to Aphides alone, but prey with equal avidity on a host of other injurious insects, even the unsavory chinch-bug is not free from their attacks.

Fig 42.



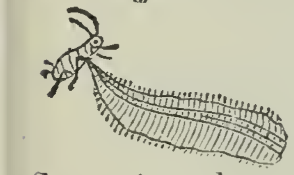
a, Larva of Syrphus fly. b. Part of a segment highly magnified.

They usually pass the winter in their coocoons, though some appear to live on until spring in the perfect state.

Other inveterate enemies of the plant-lice are certain two-winged flies which belong to the order *Diptera* and family *Syrphidæ*, of which the genus *Syrphus* is the type, or rather contains the typical species. (See figs, 20, 41, 42 and 43).

These somewhat resemble the common house-fly in size and shape, but are much handsomer, being usually of a bright yellow color, with bands and spots of black; the abdomen is flattened, and usually marked with bands or partial bands of black. They are known in some sections as "corn flies," as they are often seen in great abundance, about the time the corn is in bloom, hovering around the stalks, poised in the air apparently almost motionless. Sometimes they are called "sweat-flies," from the fact that on hot, sultry days they are most numerous. They drop their eggs one in a place, upon the leaves and twigs which are infested with plant-lice, led by instinct to know that these will form appropriate food for their young, although they as perfect insects, feed on the sweets of flowers and other similar food. The larvæ which hatch from these are maggots without any distinct head, not even possessed of eyes, but compelled to seek their food by blindly exploring the surface of the leaf on which they are placed. They are somewhat of an elongate wedge shape, blunt and broadest behind, and tapering forward to the front. When one is feeding it elongates the front part of its body, and feeling around until it finds an Aphis, fastens upon it by its mouth, raises it in the air, and proceeds to suck the fluids from its body until nothing but the shell remains.

Fig. 43.



Syrphus larva feeding on a plant-louse.

These worms or maggots, are usually of a transparent greenish color, sometimes more or less clouded or spotted with other colors.

Quite a number of species belonging to this genus are found in Illinois, but as these have not been identified, and I am not at present supplied with specimens I am unable to give discriptions.

Certain minute mites, belonging probably to the genus *Trombidium*, have also been found preying upon plant-lice, and, as I suspect, also upon their eggs. Some birds also assist in diminishing their numbers.

This array of enemies, which might be greatly increased, will show that nature has been careful to provide means for keeping in check these prolific vegetable parasities, without whose aid plants would necessarily soon be destroyed.

ARTIFICIAL MEANS OF DESTRUCTION,

The external envelope of the plant-lice is so delicate, and their hold on life, so far as the individual is concerned, so easily broken, that they are usually quite easily destroyed by the direct application of any acid substance to their bodies. As they live out their entire lives on a very limited portion of the plant they occupy, it follows that they must be attacked directly, and while on the plants they infest. It is true that there is usually one brood or generation that passes the winter in the egg state; but so far the closest scrutiny has been enabled to follow but few through this period, and the eggs are not only so minute as to render their discovery difficult, but they are more tenacious of life than the adult apterous individuals of the summer broods. It is apparent, therefore, that the most accessible point and vulnerable period of their existence is during the summer, while they are at work upon the plants; and the remedy must be one which will destroy the lice without injuring the life or value of the plant. As they are too minute to be picked off by hand, even from the most valuable plant, if at all numerous; and cling by their inserted beaks too closely to the leaves and bark to be easily dislodged, our remedies are limited almost entirely to direct applications of such character as will kill them without destroying the plant.

In some cases as with the cabbage and some other garden vegetables, some small plants, such as flowering annuals, pot plants etc., which are attacked by species which limit their operations to the leaves, it is possible, by being watchful, to check them by removing, as soon as they appear, the leaf or leaves on which they commence operations. If this is done in time, and any stray winged specimen seen on the plant destroyed, the remedy may be effectual. This is one of the remedies practiced in England for the species which attacks the turnip crops. While it is often well to make use of this remedy, especially in cases of isolated pot and some other plants, the objection to relying wholly upon it even in these cases is, that if but a few stray individuals are overlooked they soon spread their colonies over the foliage, and some more effectual means of destroying them has to be adopted.

The following are some of the remedies which have been suggested, each of which may, under certain circumstances, be used with advantage.

One of the most common, and one easy to apply, is drenching the plants infested, with strong or acrid solutions, such as strong soap-suds, weak lye, tobacco water, lime water, soap-suds and tobacco water, mixed, to which sometimes sulphur is added, etc. The application to be made as complete and thorough as possible.

Where the plants cannot be thoroughly drenched, which is usually the case, the solution may be applied with a watering pot or garden syringe, or on the limbs or twigs of trees with a whitewash or other similar brush, or even an old broom. Such application, it must be remembered, only destroys the lice it touches, and if but a few, here and there, are left, their powers of rapid reproduction will enable them soon to establish new colonies, and the work will have to be done over again; hence, wherever the plants can be absolutely drenched, this is the best method. Where the terminal twigs and leaves only of bushes and low trees are affected, these may be bent down and dipped in a basin holding the solution. A solution of strong carbonate of ammonia—half an ounce to one quart of water—is recommended, especially where the lice are on fruits or leaves which are to be eaten, as it is both clean and effectual. Another remedy, where the application is on an extensive scale, is dusting the plants with lime; this is recommended by Dr. Harris for infested potato fields; I would also suggest it for the Grain Plant-louse *Aphis granaria*, where found on winter wheat in the spring before gathering about the heads. For the latter species Dr. Fitch recommends dusting the grain with dry power of chloride of lime.

For the Carrot Plant-louse (*Aphis dauci*) Curtis recommends dusting powdered tobacco over the crowns early in the morning while the due is upon them, or watering them with a decoction of tobacco.

The most effective remedy where it can be applied, is tobacco smoke or the fumes of burning tobacco, sulphur, etc. But to render these successful the plant must be covered in some way, so as to confine the smoke or fumes and cause them to penetrate to all parts. A frame in the shape of a box or bell, covered with cheap cloth of any kind, will answer very well for the flower or vegetable garden, and might be used also for small bushes.

Various means of using this remedy will suggest themselves in connection with the means at hand and the plants to which it is to be applied; the object to be attained being, to confine the smoke of the fumes immediately around the lice long enough to suffocate them. Sometimes a minute or two will suffice, where the application is strong and direct; but usually ten or fifteen minutes, or even longer will be necessary, where the lice are numerons and in compact colonies.

It is possible that an apparatus may be invented for the direct application of tobacco smoke or sulphur fumes, something on the plan of sand bellows, with which painters dust sand over woodwork, or similar to the Babcock extinguisher.

If it possible to bring into use, at a reasonable expense, something of this kind sufficiently large to reach, through hose or pipes, the limbs of trees, it would be exceedingly useful not only against aphides but numerous other insects.

REMARKS.

Although, as heretofore stated, most cultivated as well as uncultivated plants are more or less subject to the attacks of one or more species of plant-lice, yet in England, and I believe so far as observed in this country, clover appears to be singularly exempt.

The potato, which is subject to the attacks of so many other insects appears to have no plant-louse peculiar to it or that can properly be called a potato plant-louse. It is occasionally attacked by the *Bean Aphis*, and some other species, but it is very rarely the case, that it is injured by these insects. Curtis states, that in 1847, when the Aphides were abundant in certain parts of England, destroying the bean crop, potatoes in the same garden were not injured. Harris speaks of plant-lice sometimes infesting potato fiields, but I presume he alludes to the occasional visitations, such as I have mentioned.

In this country the apple, plum, cherry, currant, willow, grape, cabbage and a few other vegetables appear to suffer most from the attacks of these insects; occasionally wheat and corn are injured somewhat seriously in limited localities. Green-house and other in-door plants, if not carefully watched, are likely to be seriously injured by them, but a little precaution with a knowledge of the proper remedies and preventive measures, such as those recommended, will generally suffice to eradicate them.

If the latter part of the winter is open, and the spring warm, bringing them out in advance of their enemies, they are then more apt to be abundant and injurious than ordinarily, as they are thus enabled to get the start of the latter, and the ascendency thus obtained, is not easily overcome.

The true Aphides are generally quite sensible to cold, being largely destroyed by heavy frosts. and severe cold spells; but, as already shown there are exceptions to this rule; and it is more than likely, that this depends to a great degree upon the effect the cold has upon the plants on which they reside. Some, and possibly most, of the woolly species appear to be less injured by the cold, than the various species of *Aphidinæ*; but it is quite natural that this should be so as the latter reside chiefly on the foliage of plants, while the wooly species are found chiefly on the stems, branches, trunks and roots.

It is supposed by many that the insects of this family are easily affected by water, but Cartis states that he "has been surprised to see how slightly they are affected by wet," that "some *Aphides* attached to a willow twig were immersed in water for sixteen hours which did not appear to incommode them in the least, for, on being taken out and placed in the sun they increased and multiplied shortly afterwards." Root-lice during winter and the wet weather of spring are often subjected for a long time to moisture which does not appear to destroy them. Yet other species immersed but for twelve hours have been thereby destroyed showing a wide difference in species in this respect. The experiments tried in France upon the root form of the Grape Phylloxera indicate the inefficiency of this agency in destroying this species, as shown by the extract from the report of the commission appointed to investigate this species, given above.

The author quoted above also further remarks that "their capability of resisting some gasses or effluvia is very astonishing, for instance, I have corked some up in a quill containing a piece of camphor, which produced an atmosphere that killed most insects in a hour, but the Aphides were walking about unaffected after being confined there for twenty-four hours." The fumes of tobacco and sulphur, are perhaps the most potent gasseous agencies in destroying them which are susceptible of general practical application, and should therefore be resorted to wherever it is practicable to use them. Alkaline substances in powder or solution, acrid solutions, kerosene and oils, are generally fatal to them where they can be applied directly; but in order to be effectual these should be applied with a brush, as if but a few are left they soon replemish the colonies. I have noticed that when sprinkled with dry dust they cease to multiply and die. The amount of moisture which escapes from them while they are actively feeding is very large as may be seen by placing a leaf or twig covered with them in a bottle; in a short time the sides of the bottle will be covered with moisture to such an extent as to run down in drops. Dry dust or powder absorbs this moisture, and hardens the outer skin which is fatal to their existence.

Dr. Harris states that "lice multiply much faster, and are more injurious to plants in a dry than in a wet atmosphere." That as a very general and almost universal rule, plants are more easily injured in dry weather than in moist, is undoubtedly true; but as to the other part of the statement, I think he is mistaken as a rule, for there is scarcely an individual, who has paid any attention to this matter, who is not aware that a warm, humid atmosphere is favorable to their increase. Yet it must be admitted that there are some species, especially those that infest trees, which appear to be more abundant in dry than in wet seasons. Curtis remarks that "their increase in damp sultry weather is equally surprising; and the universal diffusion of such myriads after a thunder storm, has led, as with the black caterpillers, to the vulgar error of their falling from the clouds." He thinks it probable that electricity also assists in their rapid and sudden development sometimes observed. On the other hand, Dickson in his *Practical Agriculture*, remarks that "In such summers as are dry, beans are liable to be much injured by the attacks of the *Black Fly*, or what is often termed the *Dolphin*, the whole field, in particular cases being in danger of being destroyed in the course of a few days." Black-fly, Dolphin and Collier, are terms applied in England to a variety of the Bean Aphis. It is not stated here that it is the rapid increase of these insects in such weather that renders the beans more liable to destruction in dry than wet seasons; it is therefore more probable that the weakened vitality caused by the want of moisture, has much to do with it.

As a rule, the remedies applicable to one species, are equally applicable to another of similar habits, where the one is as easy of access as the other. But the measures so far suggested, apply almost exclusively to species that operate on the surface, and not to those which enclose themselves in galls. For such species it is evident that topical applications will be of no effect, and the same thing is true of fumigations. The surest, and in fact, the only remedy which so far, has been suggested, is to pluck the leaves and twigs containing them, and consigning them to the flames.

If it should hereafter be ascertained that it is a habit of many of the foliage species to deposit eggs on trunks of trees in the crevices of the bark, as is suggested by some entomologists, and thus pass the winter, rubbing the bark, in the spring, with soft soap, will doubtless aid in their destruction. As this practice is beneficial in other respects, I think it would be well at any rate, to practice it to a greater extent than is now customary. It will be beneficial, at least, in destroying the species that reside on the trunks, and the rains will carry it down to roots, and assist to some extent, in disturbing those that work around the base and on the roots.

According to Boisduval (*Entomologie Horticola*), M. Gehin, in an article on injurious insects, (*Bull. Soc. Hist. Nat. Moselle*, 1862), expresses the opinion that the injury occasioned to the peach, supposed to be by the plant-louse that attacks the leaves, is not due solely to these insects, but in consequence of some sudden atmospheric change, which effects the leaves and renders them more suitable for the sustenance of the lice, and thus causes their more rapid development, which augments the injury. He states that where the trees are perfect and vigorous, they are seldom attacked by these insects.

This, I think, is beyond doubt, true, not only with reference to this species, but also to many others.

The wooly aphis of the apple tree, as I have repeatedly noticed, appears to attack defective, injured or unhealthy trees in preference to those which are sound and vigorous. Where these insects attack vigorous and healthy plants, they prefer those in close, confined situation, than those amply supplied with sun and air. This fact therefore suggests as a remedy proper pruning in the case of trees and proper exposure to sun and air of the smaller plants.

Some years ago a machine was invented in Paris for the purpose of forcing through a tube by means of a kind of pump, the fumes of tobacco, sulphur, etc., upon the infested portions of plants. I suggested the use of an apparatus of this kind in an article to the Prairie Farmer without then being aware that it had ever been tried. What success has attended the use of this apparatus I am unable to state, but it certainly is worthy of a fair trial. Some tender plants as a matter of course, will not bear such treatment, but the larger number will; and as it is not necessary to limit the application to tobacco or sulphur, various other materials might be tried.

SUPPLEMENT.

ARY U. OF I. URBANA-CHAMPAIGN

SUPPLEMENT.

I regret that the valuable papers on the Aphides of the United States, by Prof. C. V. Riley and Mr. J. Monell, published in Bulletin No. 1, Vol. V. of the U. S. Geol. and Geog. Surv. Terr. 1879, did not reach me in time to incorporate the additions in my report in their proper connection.

Although not yet printed the Mss. is required to be ready for publication by January 1, of each year, and submitted, yet it usually happens that it is not printed for some months after it is submitted.

Thanking the authors for an early copy, I will add in this supplement the descriptions of the new species, and such observations and criticisms, on their notes as I think are required.

SIPHONOPHORA ACHYRANTES. Monell.

"*Apterous females.* Pale green, with a dark, irregular stripe on each side of the abdomen, in fully developed specimens occasionally with an additional short stripe near the basal part of the abdomen, extending over several segments.

Winged females; head, prothorax, and sometimes the upper segments of the abdomen, brownish black; the upper part of the thorax with a narrow but conspicious, transverse yellow band; general color of the abdomen pale green, with irregular, broken, transverse, dark brown lines, three of these often becoming confluent, and producing a dark patch in the center of the abdomen, just above the honey-tubes. Honey-tubes long, cylindrical, slightly dusky at their apices. Style long, slender, slightly curved upwards, more or less dusky. Length of the antennæ a little variable, as long as the body or slightly longer. Frontal tubercles approximate at base, and somewhat porrect. Wings hyaline; stigma rather narrow and linear; stigmal vein very short, and curved much as in the genus *Callipterus*. The forks of the third discoidal vein are especially variable, their length being in one case four times and in another one-half that portion of the third vein between the base of the lower branch and the base of the forks. In the normal specimens, these distances are sub-equal. Length 2.28 mm; to tip of wings 3.81 mm.

On the under side of leaves of *Achyrantes* (Amarantaceæ)."

SIPHONOPHORA (?) CALENDULELLA. Monell.

I have some doubt as to the generic position assigned this species, but it is impossible from Mr. Monell's short and imperfect description to form a decided opinion on this point.

"*Viviparous apterous females:* General color very pale whitish-green, varying to yellowish. Antennæ whitish, as long as the body, mounted on porrect tubercles. Legs yellowish, except the tarsi. The honey-tubes and short style concolorous. Length 1.27-1.77 mm.

On the under side of leaves of *Calendula micrantha.* July, St. Louis, Mo."

SIPHONOPHORA TULIPÆ. Monell.

This appears to be a different species from that I have described under the name *Rhopalosiphum tulipæ.* One or the other of these species is probably identical with *Aphis tulipæ* Fonscol, which Mr. Monell appears to have overlooked.

"*Apterous females*: Pale green, with a dusky green stripe down the middle and darker green on the margin of the abdomen. Winged individuals with the antennæ as long as, or a very little longer than the body, mounted on conspicuous tubercles which are not porrect; apical joint long and threadlike, longer than the fifth, and about five times as long as the sixth. Honey-tubes very long, dusky at apex. Tail when extended, about twice the length of the tarsi, pale green Length 3.04 mm; to tip of wings 4.82 mm.

On petals and stigma of Tulips, April; St. Louis, Mo."

DREPANOSIPHUM TILIAE? Koch.

Siphonophora tiliae, Monell.

Mr. Monell describes his species as follows:

"*Apterous individuals*: Head and thorax yellowish or yellowish-green; abdomen green, honey tubes with the basal one third green, apical portion black.

Winged individuals: Head and thorax reddish-yellow; abdomen and style green antennæ about twice as long as the body, mounted on conspicuous tubercles. Wings hyaline. Stigma yellowish. Honey-tubes sub-cylindric, four or five times as long as the tarsi. Length 2.54—3.04 mm; to tip of wings 5.08 mm.

On the under side of linden leaves causing them to curl."

I think it quite certain that this is indentical with or but a variety of Koch's species. The number of the figure as given by Koch in his text is wrong, it should be 277 instead of 276.

SIPHONOPHORA LIRIODENDRI. Monell.

"*Winged female:* Head, thorax and two basal joints of the antennæ red. Abdomen green, Honey-tubes, and apical portion of the antennæ black. Antennæ much longer than the body; the tubercle near the apex of the fifth joint very distinct. Honey-tubes usually slightly incrassated at the base, about four times as long as the tarsi. Style slender, when fully extended one-third as long as the honey-tubes, more or less greenish. Wings hyaline. Stigma long, much tapered at base and apex; apex acute, nearly opposite the middle of the stigmal vein. Distance between the apex of the stigmal vein and the apex of the upper forklet equal to half that between the forklets. Length 2.54 mm, to tip of wings 4.57 mm.

On *Liriodendron tulipifera*, June, July; St. Louis, Mo.

The leaves on which this species lives do not curl up as in *S. tiliæ*, but soon turn brown and drop off."

SIPHONOPHORA CRATÆGI. Monell.

"*Apterious individuals:* General color pale yellowish-green, with a darker green mark on each side of the base of the abdomen and scarcely preceptible, darker green irregular marks near the base of the honey-tubes. Antennæ about three times as long as the body, black, with the basal third pale greenish; frontal tubercles fully as long as the second antennal joint; seventh joint tapering to an exceedingly slender point in the adult apeterious individuals, as long as the fourth, fifth and sixth joints taken together. Honey-tubes long and subcylindric, extending beyond the tip of the abdomen, pale, almost translucent. Style half as long as the honey-tubes, pale yellowish. Legs entirely greenish. Length 2.28 mm.

"On the under surface of leaves of *Cratægus coccinea*. July, St. Louis, Mo."

I think it quite probable, that when the winged individuals of this species are procured, it will be found that it is not a *Siphonophora*.

SIPHONOPHORA SONCHI. Linn.

S. sonchella Monell.

Mr. Monell's species is described as follows:

"General color very dark, dull, greenish-brown. Head and thorax inclined to fuscous. General color of legs green; apical half of femora black; tibiæ dusky at base and apex; tarsi black. Tail yellowish-green, very long. Honey tubes entirely black, reaching to the tip, cylindric." "Dorsum smooth. Antennæ much longer than the body, black; third joint very tubercular; fourth joint distinctly tubercular; remaining joints not so; third joint about as long as the fifth, sixth and seventh joints taken together; seventh joint as long as the fourth and fifth taken together. Length 2.28—2.78 mm.; to tip of wings 3.81 mm.

"On *Sonchus oleracea*. July, St. Louis, Mo."

I think there is no doubt, but that this is a variety of that exceedingly variable species, *S. sonchi* Linn. If Buckton is correct in the synonyms he gives, there is scarcely a constant specific character; even the smooth dorsum and yellowish tail are found in some varieties, although Buckton relies on the opposite conditions as characteristics; also every shade of color from green to brown, and from brown to red; some are marked with rows of tubercles and some are smooth. The tubercles on the antennæ, do not distinguish Mr. Monell's species from the former. *S. jaccœ*, Linn, is in all probability, a variety of this variable species.

SIPHONOPHORA CALENDULÆ. Monell.

"*Apterous individuals*—General color, brownish black; dorsum smooth and shining, a little reddish towards the honey-tubes. Legs yellow, except the knees, tarsi, and apex of the tibiæ, which are jet black. Honey-tubes black subcylindric, very long. Style yellow, slender acute, two-thirds as long as the honey-tubes, or a little less.

Winged individuals: General color black; head and thorax slightly fuscous. Antennæ black, half as long again as the body; third joint as long as the sixth and fifth taken together, very slightly tubercular: the following joints not so. Honey-tubes slightly fuscous toward the apex. Wings hyaline. Length 2.28–3.04 mm.; to tip of wings 3.81–4.56 mm.

"On stems of *Calendula micrantha;* June and July, St. Louis, Mo."

SIPHONOPHORA RUDBECKIÆ. Fitch.

Mr. Monell adds the following lists of plants on which this species has been taken, *Vernonia novaeboracensis V. Lindheimeriana*, *Solidago rigida*, *S. serotina*, *Bidens chrysanthemoides*, *Ambrosia trifida*, *Cirsium arvense*, *Silphium perfoliatum*, *S. integrifolia*, *Cacalia suaveolens*,

When large numbers of this species make their appearance in a locality, as is sometimes the case, they may be found on almost every plant in the vicinity, apterous as well as the winged, and very often with their beaks employed in pumping up the sap. I observed them in excessive numbers at Sioux City Iowa, in 1877 on the flats west of the city, near the banks of the little stream which here enters the Missouri. The numbers were so excessive, that many large plants were entirely covered, leaves and stems; I found them even on the *Carices* in the vicinity, and other plants they are not in the habit of infesting, but as a matter of course few in number, and although often, as stated, pumping the sap, but evidently dissatisfied with their food and location as shown by their movements.

SIPHONOPHORA FRAGARIÆ. Koch, var *immaculata.* Riley.

At this point Mr. Monell takes occasion to criticise my "*List of Aphidini*" as being incomplete in omitting this and some other species especially those of Haldeman and Rafinisque. This species is given in the list. The variety it is true is not mentioned, nor are the varieties of other species mentioned in that brief paper. Neither Haldeman's nor Rafinesque's descriptions were accessible to me at that time, and for the same reason I will have to omit them from this report, but thanks to his criticism, I can insert the list as he has given it.

The want of books is sadly felt by entomologists of the west, who like myself, do not have access to large libraries. Besides those mentioned, there are two or three other European works devoted entirely or in part to Aphides which after repeated trials I am unable to procure.

APHIS LUTESCENS. Monell.

"*Winged individuals:* General color bright lemon-yellow. Antennæ somewhat pilose, a little shorter than the body. The length of the joints is quite variable; in some specimens the third joint is subequal to the preceding, while in others it is one-third longer. Seventh joint filiform, very much longer than the third. Honey-tubes somewhat dusky, gently tapering from base to apex, the apical diameter being about two-thirds that of the base; about three times as long as the tarsi. Style dusky yellow, blunt at apex, when fully extended, about half the lenth of the honey-tubes. Fore wings hyaline; stigma dusky yellowish, acute at the apex, which is opposite the middle of the stigmal vein. Stigmal vein in one regular curve. Discoidal veins of the hind wings nearly parallel; subcostal comparatively straight. Length 1.65–2.03 mm; to tip of wings 3.04–3.54 mm.

On *Ascelpias syriaca.* July, September, St. Louis, Mo. Montrose, Iowa. Rock Island, Ill. Cordova, Ill."

This is probably a variety of *Aphis asclepiadis.* Fitch, which I have placed in *Siphonophora*, on account of the frontal tubercles, and the rather long honey-tubes. As will be seen by reference to my description, some of the individuals are yellow. The honey-tubes of my specimens taper as do those described by Mr. Monell. The rather short antennæ and not very prominent antennæ tubercles, approach *Aphis*, but the characters taken together, appear to me to predominate in favor of *Siphonophora* as its appropriate genus.

I may also state here that the remarkable differences between specimens of the same colony, had I not found them feeding together, and evidently the progeny of the same "colony foundress," I would at once have decided they were different species. Some dark green, almost black, and of the usual ovate form, while others were pale, even to creamy yellow; the forms differ also widely, some being broad oval and much less convex than others. Some appeared almost hirsute. I noticed in the same colony, three different forms and colors. On this account I concluded the species which I had at first described as new, was but a variety of Dr. Fitch's species, and so I think with reference to Mr. Monell's species.

SIPHONOPHORA SETARIŒ. Thos.

Aphis setariœ. Monell.

It is a matter of doubt to which genus this species belongs; the antennæ are situated on tubercular prominences which are quite distinct; but these are not closely approximate. The first joint is gibbous internally at the tip. The honey-tubes are rather long; the tail is also as is usual in *Siphonophora.* It is probable the species would be more correctly located if placed in *Myzus*, with which it agrees in several respects.

APHIS CEPHALANTHI. Thos.

Mr. Monell remarks that he supposes the semicircular fourth vein suggested my comparsion of this species with those of *Callipterus.* In this he is mistaken for I do not use this character, which was suggested by Passerini. I compared it with *Callipterus* simply on account of the dark shadings of the veins, which is so common in that genus.

APHIS MEDICAGINIS. Koch.

Mr. Monell has discovered this little species on *Caragana arborescens*, *Robinia viscosa* and *Melilotus italica*, which is the first notice we have of it in this country.

It is distinguished by the almost uniform shining black color of its body; the pale yellowish-white antennæ and legs, the former dusky at the tips, the latter with the outer portions of the thighs, and tarsi black. Antennæ but little over half the length of the bodv; honey-tubes of medium length; wings hyaline.

SIPHONOPHORA SALICICOLA. Thos.

Aphis salicicola. Monell.

There has evidently been an admixture of specimens received from Miss E. A. Smith, but this occurred before I received them. Some of the specimens cannot possibly be placed in *Aphis* while others on further examination appear to belong to that genus as suggested by Mr. Monell. Until more specimens are obtained and this matter correctly determined, the name I originally gave had better stand.

APHIS CORNIFOLIÆ. Fitch.

Mr Monell gives the following description of the winged individual of this species:

"Head and thorax dusky; abdomen dark fuscous. Fore femora entirely yellow; hind femora yellow only at base; base of tibiæ yellow in all the legs; tarsi more or less dusky. Antennæ more or less dusky, as long as or a little longer than the body. Nectaries dusky, cylindric scarcely longer than the tarsi. Abdomen truncate. Style dusky, short but distinct. Wings hyaline. The stigma projecting somewhat above the margin, much as in *A. coreopsidis*, tapered abruptly at apex. Costa and stigma pale yellow; oblique veins dusky. Length 1.27 mm; to tip of wings 2.28 mm.

On the under side of leaves of *Cornus florida*, and *C. paniculata*, June—July; St. Louis Mo."

APHIS ATRIPLICIS. Linn.

Found on *Chenopodiaceæ* by Mr. Monell and Miss. Middleton.

Walker decides that this species is but a variety of *A. rumicis* Linn. Dr. Fitch appears to coincide with him in this opinion. Passerini considers them as distinct.

APHIS HYPERICI. Monell.

"*Winged individuals*: General color light reddish, covered with pulverulent matter; antennæ on short tubercles, a little longer than the body; third joint as long as the fourth, fifth and sixth taken together; apical joint about twice as long as the preceding. Wings hyaline; stigmal vein much curved; distance between the base of the cubitus and that of the stigmal vein equal to the distance between the apices of the lower forklet and the lower branch of the cubitus. Nectaries very short, only detected with difficulty. Tail reddish, little over half as long as the tarsi, slender and terete.

Length 1.06-1.27 mm; to tip of wings 1.77-2.28 mm. Living in colonies on the young twigs and under side of leaves of *Hypericum kalmianum*, to which species it seems to be confined. July, St. Louis, Mo."

APHIS HELIANTHI. Monell.

"*Wingless individuals*: Varying from pale green to dark green, with various irregular and varable darker shadings on the abdomen, the most constant and conspicuous of which is a dark green transverse band on the segment above the nectaries. Nectaries dusky; style, at least the apical two-thirds, pale dusky.

Winged individuals—Head and thorax jet black; abdomen green, with a transverse band on the segment above the nectaries, and occasionaly with some darker spots on the margin. Antennæ two-thirds as long as the body, entirely black; third joint as long as the preceding taken together; fourth and fifth joints subequal. Nectaries subcylindric, pale dusky, hardly reaching the base of the style, and less than twice the length of the tarsi. Wings hyaline, venation normal Length 1.77 mm; to tip of wings 3.04-3.29 mm.

On the stems and leaves of Helianthus, St. Louis Mo."

RHOPALOSIPHUM SALICIS. Monell.

"*Winged indiuiduals*—Head and thorax dusky; abdomen green, with various irregular, darker green markings. Antennæ about half as long as the body, not mounted on frontal tubercle; the third and fourth joints somewhat dentate; apical joint half as long again as the preceding; third and fourth joints often subconnate. Nectaries light green, reaching to the tip; the basal portion slender, expanding at the middle to twice its former diameter, and again suddenly contracted at the mouth, which is furnished with the usual annulus. Tail yellowish, about one-third as long as the nectaries.

Length 1.52 mm; to tip of wings 3.04 mm. Apterous individuals entirely pale green, with two darker dorsal vittæ.

On the under side of leaves of *Salix lucida*, *S. nigra* and *S. babylonica*."

RHOPALOSIPHUM RHOIS. Monell.

"*Winged iudividuals*—Antennæ a little longer than the body, mounted on very inconspicious tubercles; joints proportioned as usual; seventh joint a little longer than the two preceding taken together. Nectaries three times as long as the slender style; the diameter of the apical two-thirds in normal specimens nearly twice the basal diameter; the apex contracted to about the same diameter as the base, and with the mouth very slightly flaring.

Length 1.52—2.02mm; to tip of wings, 3.81mm; on an undermined Sumac."

Drepanosiphum acerifolii. Thos.

Siphonophora acerifoliæ. Thos.

Mr. Monell, has followed my suggestion as to the possible position of this species and is perhaps correct.

The following in reference genera *Callipterus* and *Chaitophorus* and the species thereof is copied from Mr. Monell's paper without note or comment.

CALLIPTERUS. Koch.

Rostrum short.

Antennæ not on frontal tubercles, or else on very short ones, seven-jointed; transition from the sixth to the seventh joint very gradual.

Nectaries short, often scarcely preceptible.

Style short, enlarged at apex.

Wings deflexed; front wings with the stigmal vein much curved, not robust, usually more or less hyaline; cubital vein springing from near the base of the stigma; second discoidal sinuous.

Hind wings with two discoidals.

Body elongate, slender, of very pale colors.

Habits sporadic.

The genus seems the form a sort of transition between the *Aphidinæ* and *Lachninæ*, and should be placed in the former section principally on account of the shortness of the rostrum. Several divisions of *Callipterus* have been proposed, based on the relative length of the sixth and seventh antennal joints, but in such species as I have examined this character seems particularly variable and not deserving the importance which has been attached to it. In the species known to me, and probably in all European species, the wings are deflexed, but according to Fitch the species described by him have the wings horizontal. I was at first inclined to doubt the accuracy of this statement, but as it is a character very easy to observe, and as Dr. Fitch mentions it on two separate occasions, I do not see how he could possibly have made a mistake. Further investigation may possibly prove that his species do not appertain to this genus. As I have never been able to find viviparous apterous females, I consider it very probable that insects belonging to this genus acquire wings before producing living young.

A. Dorsum of winged individuals with spine-like tubercles *C. ulmifolii*, n. sp.

AA. Dorsum without spine-like tubercles.

  a. Marginal cell dusky.

    b. Middle tibiæ pale yellow. Femora pale yellow *C. walshii*, n. sp.

bb. Tibiæ black. Apical portion of femora black *C. bella* (Walsh).

aa. Marginal cell hyaline.

b. Wings with transverse, shaded bands.

c. Abdomen with conspicuous dusky spots *C. discolor*, n. sp.

cc. Abdomen yellow, concolorus, or with very faint transverse bands *C. asclepiadis*, n. sp.

bb. Wings subhyaline.

c. Nectaries distinct.

d. Dusky shadings at tips of veins; a dusky mark at base of stigmal vein. *C. punctata*, n. sp.

dd. Wings hyaline.

e. Apical joint of antennæ a little longer than the sixth. Veins whitish. *C. hyalinus*, n. sp.

ee. Apical joint of antennæ three times as long as the sixth. First and second discoidals black *C. betulæcolens*, n. sp.

cc. Nectaries not perceptible.

d. Wings hyaline. *C. caryæ* n. sp.

dd. Veins bordered with brown. *C. guercicola* n. sp.

Callipterus ulmifolii. n. sp. Pale whitish-yellow.

Apterus individuals—Tubercular, with capitate hairs, which disappear when the insect acquires wings.

Winged individuals—Antennæ as long as the body; third, fourth and sometimes the fifth joint slightly dusky at apex; apical joint a very little longer or shorter than the sixth. Wings hyaline; all of the veins, and especially the stigmal vein, subhyaline. Dorsum with four long, spine-like tubercles on its basal portion, and with various shorter tubercles on the apical portion. Length 1.77mm; to tip of wings 3.04mm.

On the under side of leaves of *Ulmus americana*, May—June. Closely allied to the European *C. quercus*, which has also four dorsal tubercles.

Callipterus walshii. n. sp.

Winged form—Bright yellow. Antennæ, with the tips of joints 3 to 6, black; seventh joint more than twice as long as the preceding. Thorax with a lateral black vitta extending from the eye to the wing-insertions. Femora pale whitish-yellow; fore tibiæ black; middle tibiæ faintly dusky; hind tibiæ more duky than the middle pair. Tarsi and tips of tibiæ black. Nectaries yellowish, half as long as the tarsi. Wings hyaline. Front wings with the entire costa as well as its nervures black to the tip of the stigma, whence there extends a marginal dusky vitta, as wide as, or a little wider than, the costa at base and middle, but tapering at the tip and extending a little beyond the upper furcal of the cubitus. The stigmal vein lies entirely in this vitta, and curved so as to make the width of the marginal cell just equal to the distance between the apex of the stigma and that of the stigmal vein. Hind wings with a dusky costal vitta extending to the tip of the wing. Remaining veins of both wings slender and pale dusky. Length 1.27 mm; width of abdomen 0.5mm; length of wing 1.77—2.03mm; to tips of wings 2.28—2.54mm.

May—July; St. Louis, Mo.

On the under side of leaves of *Quercus rubra.*

Very closely related to *C. bella* (Walsh), with which it has been hitherto confounded.

CALLIPTERUS BELLA. Walsh.

Aphis bella, Walsh, Genera of N. Am. Aphidæ Phil. Ent. Soc. 1862.

In some specimens, a series of capitate hairs can be detected on the margin of the abdomen of the unborn larvæ, which can be seen through the sides of the abdomen of the viviparous females. The young of some individuals seem to lack these hairs. A similar case has been noticed by Professsor Riley in *Schizoneura fungicola?* (Walsh) in which the very young larvæ occur with and without capitate hairs. These hairs, on being very highly magnified, appear to be hollow, with a funnel-shaped opening at the apex.

Length 2.54—3.04mm; of wings 3.55—3.81mm, to tip of wings 4.06—4.31mm.

CALLIPTERUS ASCLEPIADIS. n. sp..

Winged form—General color yellow. Antennæ filiform, mounted on very short tubercles, as long as, or a little longer than, the body; apical joint much longer than the preceding. Nectaries yellowish, short.

Apterous individuals—With capitate hairs, which disappear when the insect acquires wings; abdomen somewhat tubercular.

Winged individuals—Wings blotched with dusky or dusky brown; an irregular broad band running from the apex of the second discoidal to the apex of the upper forklet, and another running from the apex of the first discoidal towards the base of the cubitus, but becoming obsolete before reaching that point. Stigma short, abruptly tapered at apex. Distance between the tips of the first and second discoidals one-half that between the tip of the second discoidal and the lower cubital branch. Distance between the base of the cubitus and the base of the stigmal vein nearly equal to the distance between the apices of the lower forklet and the lower branch of the cubitus. Length 1.27—1.52mm; to tip of wings 2.54mm.

May—August.

Very common at St. Louis on *Asclepias cornuti* and *A. obtusifolia.* This is the first species belonging to this genus which has been found on a herbaceous plant.

CALLIPTERUS DISCOLOR, n. sp.

Winged form—Abdomen greenish or yellowish, with four rows of irregular brownish spots, often with smaller dots between them, the two middle rows becoming confluent just above the nectaries. Antennæ with the sixth joint less than the seventh. Wings with irregular dusky bands arranged similarly to those in *C. asclepiadis*. Length 1.77mm; to tip of wings 3.29mm.

Under side of leaves of *Quercus bicoler*. St. Louis, Mo., May.

CALLIPTERUS PUNCTATA. n. sp.

Winged form—General color pale yellow; abdomen with faint dusky shadings, representing the dots of the preceding species. Sixth joint of the antennæ much less than the seventh. Wings hyaline, except dusky markings at the tips of the second discoidal, cubital, and stigmal vein, and a dusky mark at base of stigmal vein. Length 1.52—1.77mm; to tip of wings 3.04—3.29mm.

On the under side of leaves of *Quercus bicolor*. May—June, St. Louis, Mo. It is possible that this is merely a variety of *C. discolor*, but I have never succeeded in finding intermediate forms.

CALLIPTERUS HYALINUS, n. sp.

Winged form—General color pale yellowish. Apterous individuals with the usual capitate hairs. Seventh joint of the antennæ longer than the preceding. Wings hyaline, without any markings, or with a scarcely perceptible shading at the tips of the wings. Stigma rather long, the distance between the base of the stigmal vein and the base of the cubitus being much greater than that between the tips of the lower forklet and lower cubital branch. Basal two-thirds of the stigmal vein subhyaline. Second discoidal not so much curved as in *C. punctata*. Length 1.77—2.02mm; to tip of wings 3.04mm.

On the under side of leaves of *Quercus imbricaria*, to which species I believe it is confined. May—June, Saint Louis, Mo.

CALLIPTERUS BETULÆCOLENS, n. sp.

Aphis betulæcolens?, Fitch, N. Y. Catl. Hom. p. 66.

Winged individuals—General color yellow; antennæ, first and second joints entirely yellow, the apical half of the remaining joints more or less dusky. Dorsum uniform yellow, without tubercles; wings hyaline; costal and subcostal veins whitish; first and second discoidals black. Stigma yellowish; basal two-thirds of the stigmal vein obsolete; apical portion hyaline, subobsolete. Nectaries yellow, a little fuscous, fully as long as the tarsi. The rostrum barely reaches the middle coxæ. Length 2.02mm; to tip of wings 3.81mm.

On the under side of birch leaves. June, Saint Louis, Mo.

Dr. Fitch's description of *A betulæcolens* is not sufficiently exact to enable one to recognize the species. It is, however, probable that it is distinct, as the measurement he gives would make his species slightly larger than the present one; besides, were they identical, it would be rather singular that Dr. Fitch should omit to mention the obsolete stigmal vein, and at the same time be at the pains to mention that the base of the cubitus was hyaline.

I am unacquainted with *Calaphis betulella* Walsh; but unless there are other distinguishing characters, the mere absence of the stigmal vein will not be sufficient to separate *Calaphis* from *Callipterus*, as there is a complete series of transitions between the two.

Callipterus caryæ, n. sp.

Winged form—General color, pale yellow; tips of the antennal joints black; legs entirely pale whitish. Antennæ a little shorter than the body; seventh joint equal to or one-third longer than the preceding; fifth joint as long as the two following, taken together. Nectaries not perceptible. Rostrum not reaching to the middle coxæ. Wings hyaline; veins pale; stigma rather short and blunt at apex. Stigmal vein subobsolete, its course being only traced with difficulty. The distance between the apex of the lower cubital branch and that of the second discoidal equal to about one-half the distance between the apices of the first and second discoidals. Apterous viviparous females and pupæ with four longitudinal rows of tubercles, each mounted with a capitate bristle.

Leaves of Walnut, Hickory, and Pecan. June—July. Saint Louis, Mo.

Callipterus? quercicola, n. sp.

Winged from—Antennæ about half as long as the body; not mounted on frontal tubercles; remote at base; third, fourth, and fifth joints equal in length; transition from the sixth to the seventh joint exceedingly gradual; seventh joint about half as long as the preceding. Rostrum short, not reaching the second coxæ; apical joint very acute. Nectaries reduced to mere openings. Style none. Wings with the veins bordered with brown. Stigma rather short, and blunt at apex; the cubital vein arising from its base. Stigmal vein not so much curved as usual in this genus, not hyaline; distance between the base of the cubitus and that of the stigmal vein equal to the distance between the furcals and less than the distance between the base of the cubitus and that of the second discoidal. Second discoidal not sinuous. Body rather elongate. Length 1.77mm; to tip of wings 2.79mm.

It is with considerable doubt that I place this species in the genus *Callipterus*. It is very probable that it should be placed under *Asiphum*; but the only description of this genus which has been published is that given by Koch, and, like the other generic descriptions which were made from memory after the loss of his eyesight, is somewhat unsatisfactory. The following is a translation of the salient points in his description:

Asiphum, Koch.—"Beak short. Antennæ rather short, the third, fourth, and fifth joints subequal, the apical joint very small, scarcely perceptible." Of this interesting species, I have only seen two winged specimens, mounted on a slide, which was communicated by a correspondent with the information that it occurred at Saint Louis, on Oak.

CHAITOPHORUS. Koch. (emend).

Similar to *Aphis*, but with the antennæ and body distinctly pilose. Style tubercle-like.

CHAITOPHORUS VIMINALIS. n. sp.

Apterous individuals.—Varying from pale green to light yellow, with two darker vittæ on the abdomen, which are often obsolete. Entire insect covered with long white hair.

Winged individuals.—Head and throax black; abdomen black, except the margins and style, which are yellow. Nectaries a little longer than thick, yellowish, often slightly fuscous. Antennæ hairy; seventh joint filiform, almost as long as the three preceding taken together. Wings hyaline. Length 1.52mm; to tip of wings 2.54mm.

On young twigs and leaves of *Salix lucida* and *S. babylonica*. The venation of the wings is exceedingly variable; in one abnormal specimen I have observed a robust transverse vein running from the middle of the second discoidal to the base of the lower branch of the cubitus, thereby forming a closed trapezoidal cell.

CHAITOPHORUS SMITHIÆ. n. sp.

Winged form—General color dusky reddish. Wings hyaline; vena very variable. Nectaries two-thirds as long as the tarsi, vasiform, contracted at the base, expanding in the middle, and again contracted the apex; the mouth flaring. Antennæ a little over half as long as the body, the third joint the longest, the fourth and fifth subequal, and the sixth joint two-thirds as long as the preceding. Seventh joint slender, very little longer than the proceeding. Rostrum reaching the third pair of coxæ. Length 2.28mm; to tip of wings 4.56mm.

On leaves of *Salix alba*. May—June. Peoria, Ill. (Miss E. A. Smith).

This species comes under *Cladobius* Koch, a genus which does not seem sufficiently distinct from *Chaitophorus*.

Though the shape of the nectaries is very remarkable, it seems to me scarcely sufficient to justify a generic separation.

CHAITOPHORUS QUERCICOLA. n. sp.

Apterous individuals—Dorsum greenish, with four rows of short tubercles, all of which, except a few in the side-rows, are black; their apical circumference with from three to five bristles; the two middle rows of tubercles stop at the head, but the two lateral rows are continued by smaller tubercles until near the base of the labrum. Rostrum reaching the second coxæ. Nectaries yellow, about as long as the tarsi, slightly enlarged at base, the mouth conspicuously flaring. Style not perceptible.

Winged individuals.—Antennæ very slightly pilose; fourth joint sub-equal to the fifth and two-thirds as long as the third joint; sixth about half as long as the preceding, and very little longer than the seventh. Wings, with the stigma and veins much as in *Ch. populicola;* the veins lying in narrow dusky bands. Length of apterous individuals 1.52—2.02mm; length of wing 2.54mm.

On the under side of the leaf near the midrib. *Quercus prinus* May—June. Peoria, Ill. Of this interesting species, I have seen a number of apterous individuals, but only a single winged specimen, which was mounted on a slide, kindly communicated by Miss E. A. Smith, of Peoria, Ill. The dorsum of the winged individual is probably not tubercular, but this cannot be decided with certainty on account of the manner in which the specimen is mounted.

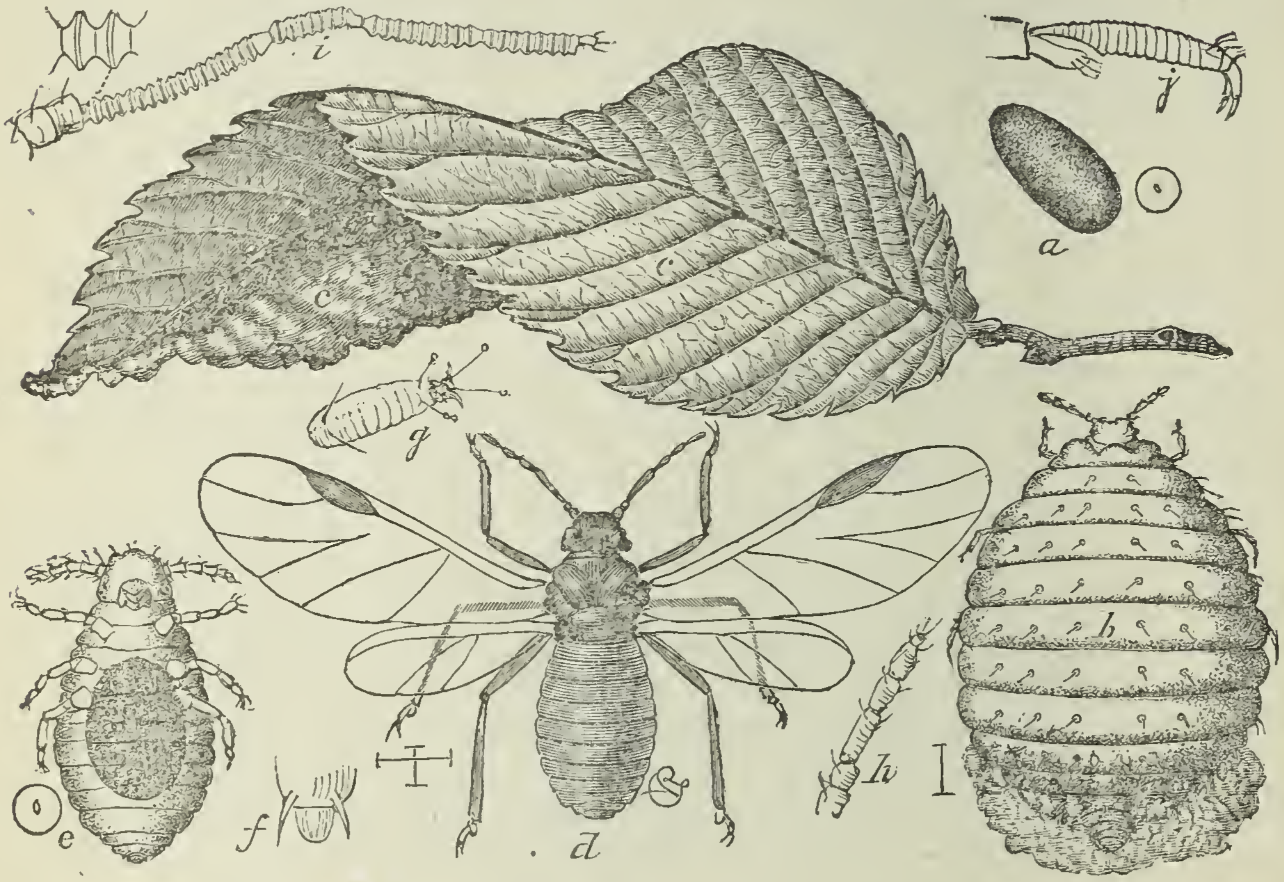
Though the antennæ of this species are not sufficiently pilose to justify its being placed in *Chaitophorus*, its general appearance seems to point to this as its rightful position.

In his portion of the paper named Prof. Riley describes some new species of *Pemphiginæ* and gives more complete descriptions of some which have been heretofore named, as follows:

Schizoneura Americana. Riley. (Fig. 44.)

Impregnated egg (fig. 44, *a.*) 0.5 mm long, gamboge-yellow, inclining to brown in color, with no special external sculpture.

Fig. 44.



"*First generation.*—Stem-mother: Pale yellowish red, with black members when first hatched; the red deepening and becoming purplish or livid with age. When mature, averaging 3.5^{mm} in length, globose or pyriform, with subobsolete honey-tubes and six dorsal rows of darker piliferous and tuberculous spots. Antennæ 5-jointed, joint 3 more than equaling 4 and 5 together in length.

"*Second generation.*—Differing in no essential respect from the preceding, except that the individuals do not attain so great a size. Bright brownish-red when born, they soon become livid brown.

"*Third generation.*—Mature, winged female: Alar expanse 5 to 5.6 mm. Body dusky, the abdomen slightly reddish; legs either dusky or yellowish-red. Antennæ as long as head and thorax together, dusky, rarely yellowish; not pilose, but with a few short setous points; 6-jointed, the 1st and 2nd joints slightly bulbous; 3rd either surpassing or equaling in length the 4th, 5th, and 6th together, which are subequal; the terminal joint usually the shortest, the apical sub-joint being normal, and in some cases sufficiently constricted to resemble an additional joint; joints 3, 4, and 5 rather distinctly annulated, the constrictions being generally quite deep, and producing a moniliform aspect, there being on an average 22 such on joint 3. Tarsi with the basal joint distinctly separated into a lobe, the claws strong, and in length twice the diameter of the tasus. Wings hyaline: front pair with the veins becoming obsolete at tips; stigma subhyaline, either of a yellowish tinge or somewhat dusky;

stigmal vein starting from the middle of the stigma and normally curved; cubital vein obsolete for nearly one-third its length, the furcal forming with it almost a point; the terminal distance between first and second discoidals equal to about five times that between their bases (often rather more); terminal distance between fureal and cubital and second discoidal veins subequal, that between stigmal and furcal slightly shorter, that between second and first discoidal one-third greater, and about equal that between stigmal and tip of stigma. Hind wings with the subcostal vein almost straight, there being no curve where it gives off the discoidal veins, which are obsolete at their extreme base, and not confluent with it. [The wing-venation is very constant. Out of of nearly 100 specimens examined, I have found only an unusual shortening of the cubital in two individuals.] The larva and pupa in this third generation differ from the winged insect in being more reddish and in having the antennæ ringed with less distinct constrictions, in the legs being paler, in the claws being stronger, and in the basal joint of tasus being more connate with the terminal joint. They have a distinct annulated elevation at each side posteriorly—a sort of pseudo-honeytube. When first born, they are of a pale dull yellow, and the antennal joints are more nearly subequal in length.

Fourth generation.—That from the first winged females: Differs from the preceding in the promuscis being much longer, in the antennæ having but five joints, the third being somewhat longest and the first shortest, but all often being of more nearly equal length, with no annulated constrictions. The color is much more decidedly orange. When newly hatched, the thickened end of the promuscis often extenps one-half the length of the body beyond anus. The legs are also long and stout, and the basal joint of the tarsus is distinct, but not separated. The capitate hairs are obsolete. It is born with an enveloping pellicle or pseudovum, and though of a bright red with pale legs at first, soon becomes brownish, with dark members.

"*Fifth generation.*—The counterpart of the second.

"*Sixth generation.*—Second winged: Resembles the third, but usually rather lighter-colored with the wing-veins, the spinous armature of surfaces, and the constrictions of antennæ less strong, and with the third joint of antennæ rather less in length than the terminal three together.

"*Seventh generation.*—True sexual individuals: Born within an egg-like pellicle. With stout promuscis reaching to between middle and hind coxæ; the antennæ 5-jointed, with the joints subequal. Bark-feeding. Orange in color. Undergoing one moult, and then being at once distinguished from the other forms by the brighter orange-yellow color, the rudimentary mouth, the more simple eyes (composed of three facets), by the shorter, 5-jointed antennæ, the joints subequal in length; by the shorter legs, with smaller claws to the tarsi, and more distinct terminal capitate hairs, or pulvilli. The skin is transparent, the body filled more or less with fatty globules. The female is nearly pyriform, and averages 0.4mm in length. A single egg is visible through the translucent skin, and, according to age, occupies more or less of the whole of the body. The male is narrower and smaller, the penis being bulbous, with a couple of spine-like genital clasps."

This as admitted by Prof. Riley is very closely allied to *Schizoneura ulmi* Linn, and it is doubtful whether it should be considered as distinct.

GLYPHINA ULMICOLA, Fitch.

Byrsocrypta ulmicola, Fitch, 4th N. Y. Rep. 1858, p. 63 (§ 347).—*Thelaxes ulmicola*, Walsh, Proc. Ent. Soc. Phil. vol. i, p. 305, 1862; American Entomologist, vol. i, p. 108, 1869.—*Colopha ulmicola*, Monell, Canadian Entomologist, vol. ix, p. 102, 1877.

"*Impregnated, or winter egg.*—Length, 0.38mm, perfectly ovoid, shining olivaceous, inclining to brown, with no particular sculpture.

"*First generation, or stem-mother.*—0.4mm long when hatched. Antennæ 4-jointed; joints subequal in length and thickness, but with the bases of hairs rather strong. Promuscis very short, reaching only to middle coxæ, or a little beyond. Upper tarsal hairs globate at tip, and as long as tarsus. Smooth, dark olive brown in color, with black members. After first molt the beak is still relatively shorter, as also the tarsal hairs; the color is paler, but the members are still black. She measures 1mm in length when beginning to bear, and the third joint of antennæ is then somewhat clavate, and as long as joints one and two together; the fourth narrower, as long as third, and rather truncate at tip, with two rather conspicuous piliferous prominences. Color, translucent yellowish green, often inclining to purple.

"*Second generation.*—0.4mm long when born; nearly five times as long as wide; the antennæ short and 5-jointed, the joints sub-equal in length, the third shortest and narrowest, the 5th swollen and sub-fusiform, with rather strong bulbs at the base of the hairs. Promuscis reaching to hind coxæ. Distinct globate tips to the four tarsal hairs. Color pale olive green, with black members and a dusky stripe on the notum. *Pupa* with antennæ smooth, 6-jointed, joints subequal in thickness, joint 4 only as long 2; 5 and 6 each twice as long; 3 four times as long. Color, dingy orange, with a paler band around the thorax, embracing the wing-pads, and reminding one, on this account, of the pupa of *Phylloxera*.

"*Winged female:*—Average expanse 3.7mm; the form of body more as in *Phylloxera*, the abdomen tapering and narrower than the thorax bearing from ten to twenty pseudova. Blackish, with an olive green tint, the abdomen and under surface yellowish-green in the fresher individuals. Antennæ reaching only to insertion of front wings, 6-jointed; joints, 4, 5, and 6 subequal, and together equal to 3 in length. [Three specimens examined have joints 4 and 5 very imperfectly separated, causing the antennæ to appear as 5-jointed.] Wings as described by Walsh, the stigma being well rounded and pale. [In three specimens examined, the third discoidal of the front wing is simple and precisely as in *Pemphigus;* in one specimen, the first discoidal is wanting on both front wings, and in another the fork of the third discoidal is wanting on the left one.] Basal joint of tarsus rather short; tarsal claws only moderately strong.

"*Third generation.*—The young from the winged female, after being freed from the pellicle in which they were born, have stout five-jointed antennæ, the joints subequal; stout but short promuscis reaching to hind coxæ; rather large compound eyes. Proportions and shape of young *Phylloxera.*

"*True female:*—Legs short and the basal joint of tarsus rudimentary; antennæ short, four-jointed, smooth, joints subequal, the third somewhat longest. Mouth rudimentary. Described from skins surrounding impregnated egg. Males unknown."

PEMPHIGUS POPULI-MONILIS. Riley.

"*Winged female* (Fig. 45, a):—Average expanse 6.5mm. Black, the abdomen a little lighter, especiall, at the tip. Finely powdered with white; broad across the shoulders, the scutellar lobes of the mesonotum being rather more flattened than the præscutum; the head rather small and narrow. Antennæ (Fig. 45, *b*) and legs rather short, the former reaching only to base of front wings; 6-jointed; joints 1, 2, 4 and 5 subequal in length; 3 twice as long; 6 not quite as long as 3. Joints 1 and 2 very stout; 3, 4 and 5 somewhat clavate; nearly smooth above, but with about twelve deep constrictions beneath. Legs normal, with basal joint of tarsus (Fig. 45, *f*) tolerably well separated, and unguis stout. Wings subhyaline; front wings with stigma strongly angulate, dusky, the lower portion almost black. Veins dusky, the costal and subcostal stout and darkest. Stigmal vein undulate, starting from a little beyond the middle of stigma. First and second discoidals almost connected at the base [in three specimens entirely so], and the distance between them at tips about one-third greater than between 2d and 3d discoidals, and that between these two subequal with that between the last mentioned and stigmal; the 3d discoidal obsolete toward base. Fold of hind border but moderately thick. Hind wings ample, the hook-angle but moderate, the subcostal slightly undulate

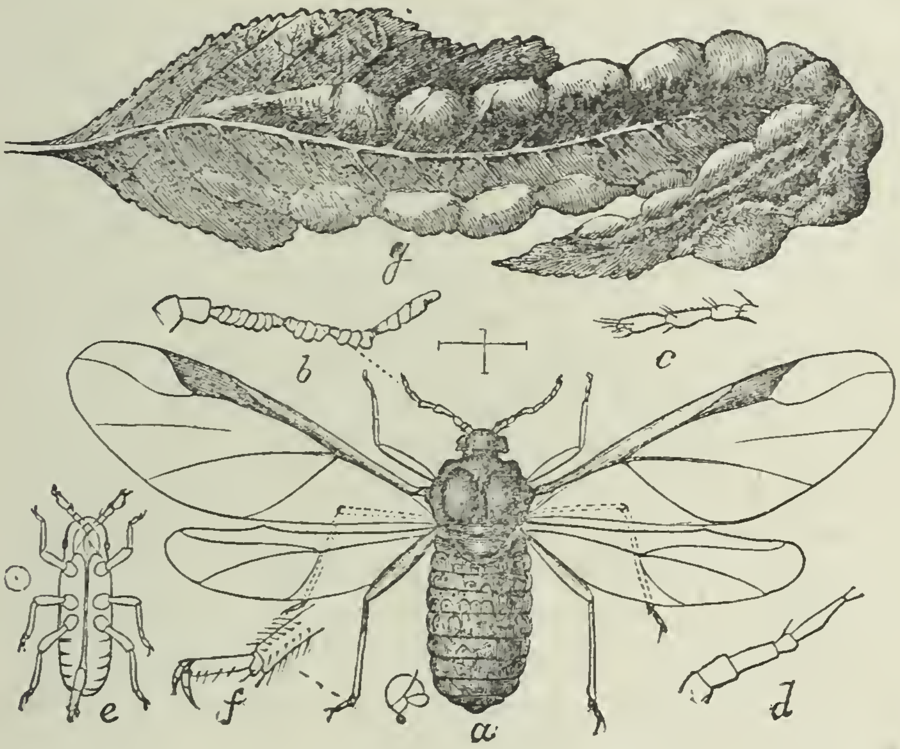


Fig. 45.

and considerably elbowed at basal third, whence spring the discoidals, the first bending slightly toward posterior margin, the second toward costal margin, the spaces between the tips of the costal and the discoidals subequal, and together rather more than half of posterior border. [An examination of fourteen specimens only showed one with the third discoidal forked on both wings, and another with the same vein forked on the left wing, and the second discoidal also forked near tip.] When newly hatched, or in the first age, the basal joint of tarsus is scarcely perceptible, and the tarsal hairs are simple; the antennæ (Fig. 45, *c*) are 4-jointed, the basal joint half as long as the 2d; 3d and 4th somewhat longer and subequal; the 4th suddenly narrowed at tip; the promuscis reaches beyond hind coxæ. After first molt, the antennæ (Fig. 45, *d*) are 5-jointed, the 4th very short and almost globular; the promuscis now reaches to the middle coxæ only. In the pupa state, the antennæ are 6-jointed.

Young from winged female similar to the same stage of its parent, except in the promuscis reaching beyond anus (Fig. 45, *e*). Length 0.15mm.

Throughout Central Colorado, July (Riley); Southern Kansas (Monell).

This species forms a very interesting gall, which may be called the bead-like cotton-wood gall, occurs on the narrow-leaved cotton-wood (*Populus balsamifera*, L., var. *angustifolia*, Torrey), during the summer, in Colorado, and probably wherever this narrow-leaved variety grows. Though I have often found the tree in question so covered with these galls, especially at Greeley, that not a leaf was exempt, yet *Populus monilifera*, even when growing along the bank of the same irrigating ditch and mingling its branches with *angustifolia*, would be entirely free from them. The galls when not very numerous appear most commonly on the terminal leaves of a twig. They form a confluent series of pale yellow ovoid swellings, each side of the midrib (Fig. 46, *g*) recalling, in the distance, a lot of unripe, cherries, or, again, the galls produced on a true willow by the Sawfly larva—*Nematus salicis-pomum*, Walsh. There will sometimes be three rows of these swellings, and they are not infrequently tinted with red. There are, however, more often but two rows, occupying nearly the whole space each side of the midrib. The galls are formed by the folding under of the sides of the leaf and the bulging of the same around the insect, which is always found solitary."

HORMAPHIS SPINOSUS. Shimer.

"*Hamamelistes spinosus*, Shimer, Trans. Am. Ent. Soc. i, p. 284, 1867.

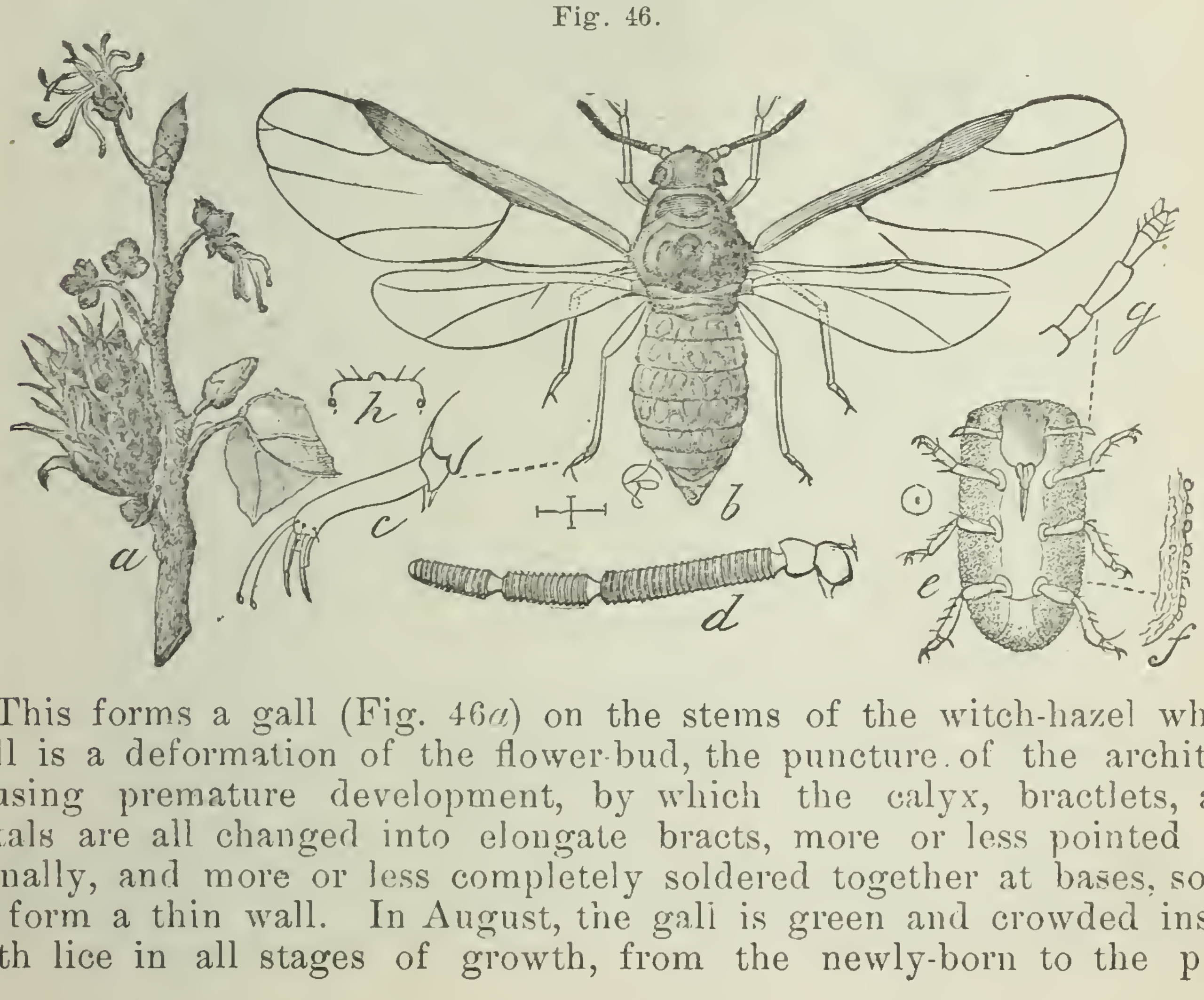
Winged female (Fig. 46, *b*): Expanse 5mm. Color dark brown, uniformerly pulverulent, the abdomen slightly paler and filled with egg-like bodies. Head with a frontal tubercle, and with the promuscis not reaching to beyond front coxæ. Antennæ (Fig. 46, *d*) reaching to base of front wing; 5-jointed, joints 1 and 2 bulbous and smooth, the others with about 50 close and regular and well-defined annulations;

joint 3 six times as long as 1 and 2 together; joints 4 and 5 each half as long as 3, the terminal joint not being narrowed at tip.

Thorax with the pronotum welled defined, mesonotum having a thickened anterior border, with two small angles in front; the scutellar lobes and and præscutum small. Tibiæ with a lobe each side at juncture with tarsus, the basal joint of tarsus not distinctly separated and the tip furnished with two superior, knobbed hairs. Wings hyaline, the stigma and costal area fuliginous, the stigma pointed, but only slightly broadened; first discoidal almost transverse, second do, starting from it at upper third; cubital running straight toward base of first discoidal, but usually obsolete at basal half; terminal space between second discoidal and cubital wider than between it and the stignal. Hind wings with the hooks strong, the costal vein straight, and a single discoidal, the first being obsolete. [Out of 20 specimens examined, I find the basal portion of the first discoidal of front wing connecting with the second at base, either on one wing (2 specimens) or on both wings (4 specimens), and in two cases this first discoidal is complete on one wing and incomplete on the other.] *Larva* quite broad and squarish anteriorly, with a frontal tubercle (Fig. 46, *h*), and with the antennæ four-jointed; promuscis reaching to hind coxæ; color brown, with mesonotal lobes more yellowish. Transverse dorsal rows of four piliferous spots are faintly observable. Antennæ after first molt five-jointed, and promuscis hardly reaching to middle coxæ. *Pupa* with similar antennæ and somewhat shorter promuscis.

Young from winged female (Fig. 4, *e*); Resembling the larva of preceding generation, but distinguished by the absence of frontal tubercle, and by having the surface, except mesio-ventrally, evenly and conspicuously granulated. The terminal joint of antennæ also shows some constrictions (Fig. 46, *g*).

Fig. 46.



This forms a gall (Fig. 46*a*) on the stems of the witch-hazel which gall is a deformation of the flower-bud, the puncture of the architect causing premature development, by which the calyx, bractlets, and petals are all changed into elongate bracts, more or less pointed terminally, and more or less completely soldered together at bases, so as to form a thin wall. In August, the gall is green and crowded inside with lice in all stages of growth, from the newly-born to the pupa and winged female, intermixed with floculent matter and watery globules, the insects themselves being rather evenly covered with a fine white powder. Later in the season, the tips of the bracts become blunter, and the gall becomes browner, and recalls externally the fruit-pod which would have developed the ensuing year. It is now perforated at some point, generally near either the top or base, and through the aperture the insects have either made their exit or may be noticed doing so. The young from the winged female are quite characteristic, being strongly granulated, and, as they were found as late as the end of October, they probably hibernate on the permanent parts of the tree. The sexed individuals and the stem-mother are yet unknown. The species was first described in 1867 by Dr. H. Shimer of Mt. Carroll, Ill., who erected a new genus for it and another well-known species on the same plant, not aware that the genus had been previously characterized by Baron Osten Sacken, in 1861."

PEMPHIGUS POPULI-TRANSVERSUS. Riley.

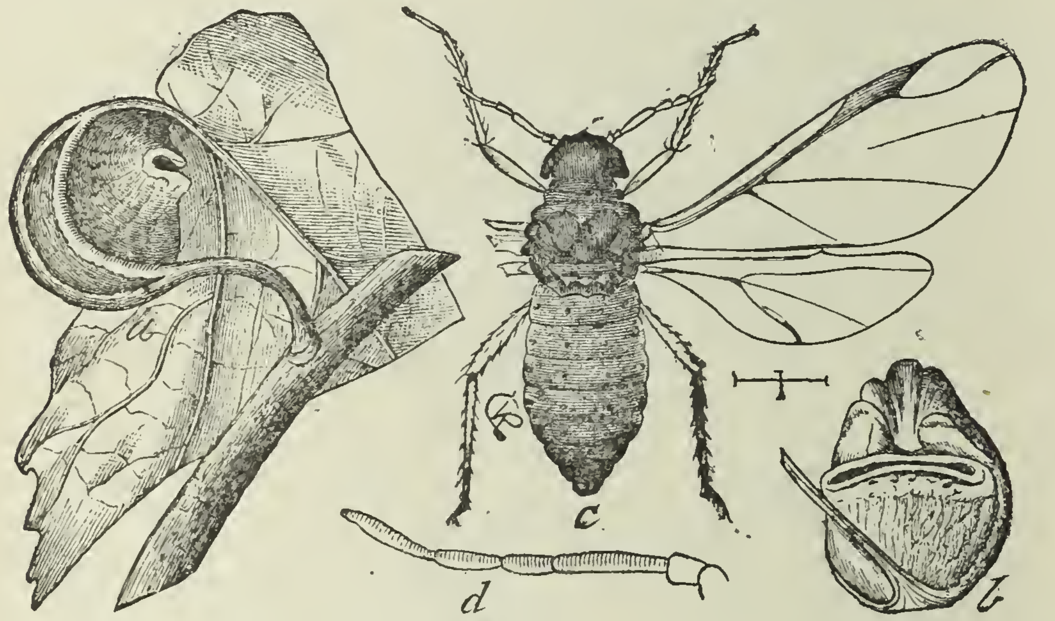


Fig. 47.

"[Gall (*populi-transversa*, Fig. 47,) formed upon the petiole near the base of the leaf of *Populus monilifera* and *P. balsamifera*. An elongate-oval swelling, causing the curving and broadening of the petiole, and opening on the opposite side by a transverse slit, with a whitish, slightly thickened, and elevated margin, recalling human lips. By the latter part of June the stem-mother is surrounded with young of various sizes, all covered with the usual white secretion and mixed with the liquid globules. Winged females produced in autumn, sometimes not until the leaves have fallen.]

Winged female (Fig. 47, *c*).—Expanse, 7mm. Pruinescent, with the abdomen more yellowish, inclining to green. Antennæ (Fig. 47, *d*) reaching a little beyond the base of front wings; smooth; joints three, four and five cylindrical, and of equal thickness; three as long as the other two together; six more slender at base, and with the apical unguis nearly as long as three. Thorax with mesonotal swellings small. Terminal distance between first and second discoidal veins of front wings nearly equal to that between this last and the stigmal vein; discoidals almost connected; cubital obsolete at base; subcostal heavy; stigma scarcely wider than subcostal space, acuminate at tip, and with the vein starting a little in front of its middle. Hind wings with the discoidals connected at base, where the subcostal is slightly produced. Legs normal. Abdomen showing about thirty pseudova, and with four dorsal rows of faint piliferous dots. *Pupa* with joints one, two, four and five of antennæ subequal in length. The wingless forms are pale creamy yellow, with faintly dusky members.

Missouri, Southern Texas, and Colorado (Riley). May possibly be *popularia*, Fitch, the description of which does not admit of identification.

This gall occurs all over the West and Southwest, and while it normally occurs in the position and of the form described, it may occur on any part of the petiole, and the opening may be more or less oblique, or form a mere circular hole. Sometimes two and even three coalesce. The lip-like bulging is, however constant."

PEMPHIGUS POPULI–RAMULORUM. Riley.

"[Forming an irregular globular gall (*populi-ramulorum*), often somewhat flattened, on the twigs of *Populus balsamifera* in Colorado. The gall averages 15mm in diameter, and opens in a suture sometimes transverse, sometimes oblique, but more often longitudinal with the axis of the twig, exceptionally the opening is round and bulging. Green when fresh, it becomes gray and woody with age.]

Winged female—Alar expanse 6.8mm. Black and pruinescent, scarcely distinguishable from *populi-traversus*, except by the more annulate antennæ, the 4th, 5th, and 6th joints of which are much narrowed at base. The 6th joint (including subjoint), scarcely as long as 3d. The pupa is yellowish, with black eyes, and pulverulent.

Colorado (Riley).

Several of the species of *Pemphigus* forming galls upon *Populus* so closely resemble each other that they could not well be seperated as species were it not for the differences in the galls they produce. Future careful investigation may show that the same species will produce different abnormities. and be slightly modified in appearance according as it affects different parts of the plant; but until we have such proof, the presumption is that the different galls are produced by distinct species, however similar the architects are in general appearance."

PEMPHIGUS ACERIFOLII, Riley.

"[Living in abundant and long cottony excretion, on the under side of the leaves of *Acer dasycarpum*, causing them to curl, and exuding an abundance of thick and very glutinous "honey-dew."]

Winged female.—Alar expanse 10mm. Head and thorax bluish-black. Abdomen black, covered with long cottony threads. Antennæ reaching the wing-insertions; annulations not conspicuous; joints 3, 4, 5 and 6 somewhat contracted at base and apex; apical unguis not perceptible; joints 5 and 6 subequal; 4 distinctly clavate; 3 as long as the two preceding together. Wings subhyaline, of a whitish tinge; subcostal vein and the inner margin of the stigma black; oblique veins whitish, stigma short and broad, not angled at the base of the stigmal vein, which starts from a little behind its middle, and is comparatively straight thereby making the apical cell rather narrow. Terminal distances between the veins sub eqnal that between 2d discoidal and cubital somewhat greatest; basal one-third of the cubitus hyaline, but not abortive, as it can usually be traced to its base, which is very close to that of the second discoidal; bases of the two discoidals either approximate or quite contiguous; discoidals of the hind wings preceding connectedly from the subcostal vein. Larva with 5-jointed antennæ and the promuscis extending beyond tip of abdomen.

June—July; St. Louis, Mo. (Riley); Clinton, N. J. (Prof. W. D, Robbins)."

PEMPHIGUS FRAXINIFOLII. Riley.

"[Infesting the terminal leaves of *Fraxinus americanus* and *F. sambucifolia* from spring till late summer, and producing a twisted curl thereof; the young lice varying in color from deep glaucous to livid, very flocculent and exuding the liquid globules quite copiously. Winged females appearing early in June.]

Winged female: Alar expanse 5.7mm. Head and thorax dusky; abdomen dark green; antennæ reaching by the length of the apical joint beyond costal base of front wings; inconspicuously annulated and with joints 3—6 but moderately narrowed at base; joint 3 as long as 4 and 5 together; 6 (including unguis) nearly $\frac{3}{4}$ as long again as 5, with the unguis distinct and of normal length. Scutellar lobes of mesonotum broad and well marked. Legs normal. Wings hyaline; stigma linear, or not wider than subcostal space, yellowish and poorly defined anteriorly; veins very slender and sub-hyaline, the stigmal most distinct, starting a little in front of middle of stigma, and but faintly curved; cubital almost invisable, but not obsolete at base, where it nearly joins the 2d discoidal. Terminal spaces between 1st and 2d discoidals, and between this last and cubital, subequal; that between cubital and stigmal only half as great. Discoidals of hind wings proceeding connectedly from sub-costal. Promuscis reaching beyond front coxæ; abdomen with 7 rather large roundish spots each side, each sending out 2 hairs. [In some specimens the cubital starts independently from the subcostal; in others it joins the 2d discoidal a short distance from base]. *Pupa* with the 3d joint of antennæ relatively somewhat shorter.

Larva of probable second generation: Antennæ smooth, 4-jointed; joint 3 somewhat longer than 4, and as long as 1 and 2 together: apical nipple 1-6th as long as the 4th joint. Promuscis slender, reaching beyond hind coxæ. Legs rather long and stout. Tibiæ, tarsi, and anal joints of abdomen with a few conspicuous hairs. Full grown, apterous female, probably of this same generation, differs in having 6-jointed antennæ, proportion much as in the winged female.

Larva from winged females; probable fourth generation: Antennæ 5-jointed; joints 1, 2, 3, 4, subequal in length; 3, 4, stourter; 5 very shourt and rounded at tip. Promuscis very long, reaching beyond tip of abdomen.

Tolerably common at Saint Louis, Mo. (Riley, Monell); Sauk City, Wis. (Thomas).

The life-history of this insect has not been fully studied, as the sexed individuals, and the winter egg have not been observed. It will doubtless be found to agree in most particulars with that of *Schizoneura americana.*

The species stand somewhat in the same relation to the European *Pemphigus fraxini* (Fabr.) as does *Schizoneura americana* to *S. ulmi*, The European species is larger, with the wing-veins differently placed, and inhabits the twigs and stems, instead of the leaves; but otherwise there is a good deal of resemblance between the two."

This is undoubtedly the same species that I have described under the same name in the preceding part of this report. As Prof. Riley's description was published first, his name must stand as author of the species.

The following list of species of plant-lice described by Haldeman and Rafinesque is taken from a note in Mr. Monell's paper. As I have not acess to the works of these authors I am unable to give the descriptions or to assign the species to their proper positions.

Aphis rubecula Haldm. Proc. Bost. Soc. Nat. Hist. vol. i, p. 168, 1844.
Aphis bicolor Haldm. l. c. p. 168.
Aphis marginipennis Haldm. l. c. p. 168.
Aphis pilosa Haldm. l. c. p. 169.
Aphis discolor Haldm. l. c. p. 169.
Aphis verticolor Raf. Am. Monthly Mag. and Critical Review, i, p. 361, 1817.
Aphis furcipes Raf. l. c. i, 361.
Aphis rhodryas Raf. l. c. iii, 15, 1818.
Aphis diplepha Raf. l. c. iii, 15.
Aphis oreaster Raf. l. c. iii, 17.
Aphis gibbosa Raf. l. c. iii, 17.
Aphis xanthelis Raf. l. c. iii, 17.
Aphis annulipes Raf. l. c. iii, 17.
Aphis ambrosia Raf. (nec Thos). iii, 17.
Aphis acaroides Raf. 1. c. iii, 17.

PSYLLIDÆ.

Since the foregoing report was placed in the hands of the printer, I have obtained a copy of the Transactions of the Entomological Society of London for 1876, containing a "*Monograph of the British species* *of Psyllidæ*," by Mr. John Scott. For the benefit of those who may desire to investigate this interesting group of insects, I insert here the author's synoptical table of genera.

Brief Synopsis of the Genera.

A. Face produced into two lobes of greater or less length; antennæ 10-jointed; 1st and 2d joints short, stout, remainder filiform; 3d generally longest.
  a. Elytra coriaceous; costa without a stigma; cubitus petiolate *Livilla.*
  aa. Elytra membranaceous.
  b. Apex of elytra rounded.
  c. Costa without a stigma; cubitus petiolate. *Arytaena.*
  cc. Costa with a stigma; cubitus petiolate. *Psylla.*
  bb. Apex of elytra lanceolate.
  c. Costa with a stigma; cubitus petiolate. *Spanioneura.*
  cc. Costa without a stigma; cubitus not petiolate. *Trioza.*
AA. Face not lobate. antennæ 10-jointed; first and second joints (except in *Livia*) short, stout, remainder filiform; 3d generally longest.
  a. Elytra membranaceous; apex rounded. *Aphalara.*
  aa. Elytra coriaceous; more or less lanceolate.
  b. Costa with a stigma; cubitus petiolate. *Rhinocola.*
  bb. Costa without a stigma; cubitus petiolate. *Livia.*

INDEX.

I. INDEX TO PLANTS.

This index is in two parts. First: Index to the plants mentioned; second, general index exclusive of plants.

PAGE.
Abies nigra 117
Acer dasycarpum 209
    pennsylvanicum 49
    pseudo-platanus 79
Achyrantes 187
Acorus calamus 14
Alder 118, 139
Almond 162
Alnus rubra 139
Ambrosia psilostachya 50
    trifida 49, 190
American larch 117
Apocynum cinnabinum 94
Apple-tree 85, 86, 126
Aquilegia 83
Artemesia absinthium 69
Asclepias cornuti 58, 197
    obtusifolia 197
    syriaca 191
Ash, European 147
Aspen 149
Aster 99
Atriplex 88
    hortensis 88
Balm of Gilead 105
Balsam poplar 153, 174
Barberry 82
Barley 51
Bean 88
Bed-straw 88
Beech 120, 139, 140
Bidens chrysanthemoides 190
Birch 110, 199
Blackberry 17, 18, 64, 121
Black spruce 117
Bottle grass 56
Box elder 103
Bramble 64
Broom 64 69
    Dyers 88
urning-bush 88
urr oak 108
utton-bush 97
abbage 91
acalia suaveolens 190
alendula micrantha 100, 190
anada flea-bane 58
apsella bursa-pastoris 98, 98
aragana arborescens 192
arices 191
arnation pink 80
arya alba 162, 164
    amara 164
    glabra 163, 164
    porcina 116
erasus vulgaris 75
eratochlora australis 139
henopodiaceæ 193

PAGE.
Chenopodium album 88
Cherry, Garden 75
    Choke 93
Chestnut 114, 164
Choke cherry 93
Cirsium altissimum 100
    arvense 187
Cockscomb grass 56
Coreopsis aristosa 59
Corn 89, 122
Cornus florida 193
    paniculata 101, 193
Cottonwood 104, 149, 151
Cranberry, high 96
Cratægus coccinea 189
    punctata 101
Crepsis 62
Currant, Red 77

Dahlia 88
Diospyros virginiana 96
Dock 88
Dogsbane 94
Dogwood 101
    Red-osier 142
Dyer's broom 88

Elder 100
Elm 112, 119, 140
    White 136, 142
    Red 153
Endive 168
Eragrostris poæoides, var megastachya 139, 145
Erigeron canadense 58, 100, 168
Euphorbia maculata 57
    marginata 57
Euonymus 88

Flea-bane 58
Fox-tail grass 56
Fraxinus americanus 21
    excelsioris 14
    quadrangulata 14
    sambucifolia 21
Fungus 14

Galium aparine 8
    circæzans 8
Garden orache 8
Genista 8
Gerardia tenuifoliæ 6
German ivy 8
Golden rod 4
Gooseberry 7
Grape 55, 15
Gray willow 11

Helianthus 19
Heuchera hispida 6
Hickory 162, 171, 19
    Bitternut 16
    Pignut 116, 16
    Shagbark 16
Honey-suckle 10
Hop-vine 7
Hornbeam 1
Hypericum prolificum 10
    kalmianum 19

Impatiens fulva 9
Indian corn 89, 12
Iron oak 16
Ironweed 97,
Ivy, German 8

Knot-weed ....
Lactuca oleracea ....
    sativa ....
    scariola ....
    virosa ....
Larch, American 117, 1
Lathyrus odoratus ....
Leguminosæ 1
Lettuce 60, 61, 62, 1
Linden 120, 1

PAGE.
Lirodendron tulipifera ... 189
Lonicera ... 104
Maize ... 89, 122
Maple, Soft ... 47
  Sugar ... 18
Meadowsweet ... 65
Melilotus italica ... 192
Mentha viridis ... 69
Milkweed ... 58
Mint, Garden ... 69

Nectarine ... 76
Negundo aceroides ... 103
Nerium oleander ... 95

Oak, ... 79, 107, 139, 200
  Bur ... 108
  Iron ... 163
  Red ... 113
  Swamp-white ... 163
  White ... 118, 163
Oats ... 51
Oleander ... 95
Orache, Garden ... 88

Panicum crus-corvi ... 56
  glabrum ... 138, 170
Papaver ... 88
Parsnip ... 84
Pastinacea sativa ... 84
Pea, ... 65
  Sweet ... 65
Peach ... 76, 102
Pear ... 16
Pecan ... 199
Persimmon ... 96
Pigweed ... 88
Pine ... 14, 102, 156
  White ... 117, 137, 140
Pink, Carnation ... 80
Plum ... 76, 82, 87
Poa annua ... 167
Polygonum persicaria ... 62
Poplar, ... 102
  Balsam ... 153, 154
  Balm of Gilead ... 105
  Cottonwood ... 104, 149, 151
Poppy ... 88
Populus angulata ... 104, 151
  balsamifera ... 206, 208, 209
  grandidentata ... 102
  monilifera ... 149, 206, 208
  tremuloides ... 148, 149
Prunus virginiana ... 93

Quercus alba ... 163
  bicolor ... 163, 198
  imbricaria ... 196
  macrocarpa ... 108
  obtusiloba ... 163
  prinus ... 199
  rubra ... 113, 197

Ragweed ... 49
Raspberry ... 64, 148
Red currant ... 77
Red elm ... 153
Red oak ... 113
Ribes grossularia ... 62, 77
  nigrum ... 62
  rubrum ... 77
Robinia viscosa ... 192
Rose ... 50
Rubus fruticosus ... 64
  idaeus ... 64
  occidentalis ... 148
Rudbeckiæ laciniata ... 49
Rumex acetosa ... 88
Rye ... 51

Salix alba ... 201
  babylonica ... 194, 200
  lucida ... 192, 200
  nigra ... 192

PAGE.
Sarothamnus scoparius, 64, 69
Scrophularia nodosa, 72
Setaria glauca, 56, 139
  italica, 139
  viridis, 139
Shepherd's purse, 55, 88
Silphium integrifolia, 191
  perfoliatum, 191
Snow-ball, 96
Snow-berry, 99
Soft maple, 47
Solidago rigida, 190
  serotina, 190
Sonchus oleracea, 167, 190
Sorghum, 88
Spanish needle, 59
Spirea almaria, 65
Spotted spurge, 56
Spruce, Black, 117, 156
Squash, 67
Stinging nettle, 55
St. John's-wort, 108
Strawberry, 68
Sugar maple, 18
Sumac, 152
Sweet flag, 14, 15
Sweet pea, 65
Symphoricarpus vulgaris, 90

Tamarack, 117, 157
Tanacetum vulgare, 68
Tansy, 68
Thistle, 100
Thorn, 101
Tomato, 73
Touch-me-not, 98
Tufted vetch, 87
Tulip, 81, 188
Tulipa gesneriana, 81

Ulmus americana, 112, 196
Urtica dioica, 65

Verbena, 63
Vernonia fasciculata, 97
  lindheimeriana, 190
  noveborascensis, 190
Vetch, Tufted, 88
Viburnum opulus, var. americana, 97
Vicia cracca, 88

Walnut, 113, 141, 199
Wheat, 51
White elm, 136
  oak, 118
  pine, 117, 137, 140
Willow, 63, 105, 115, 119
  Gray, 116
Witch-hazel, 207
Wormwood, 69

GENERAL INDEX.

A.

PAGE.

- abieticolens 156
- abietis 117, 118. 157
- absinthii 69
- acaroides 211
- acerifoliæ 42, 195
- acerifolii 92, 209
- acerina 78
- aceris 49, 78
- achyrantes 187
- acetosa 88
- Alder Blight 139
- Alder-leaf Lachnus 118
- Almond Aphis 102
- alnifoliæ 118
- ambrosiæ 50, 211
- Adelges of the Spruce 156
- americana 15, 202, 211
- amygdali 102
- Anastis I5.punctata 174
- Anatomy, External 20
- annulata 18
- annulipes 211
- aparines 88
- Aphides 19
- Aphidæ 150
- aphidicola 19
- Aphididæ 19
- Aphidina 19
- Aphidinæ 44
- Aphidini (Section) 83
- Aphidius avenaphis 176
  - lactucaphis 175
  - polygonaphis 175
  - viburnaphis 175
- Aphis 84
  - absinthii 69
  - acaroides 211
  - acerina 78
  - aceris 88
  - acetosa 88
  - ambrosæ 211
  - amygdali 102
  - annulipes 211
  - aparines 88
  - apocyni 94
  - armata 88
  - asclepiadis 191
  - atriplicis 88, 193
  - avenæ 51
  - beccabunge 97
  - bella 106, 107
  - berberidis 87
  - betulæ 110
  - betulaecolens 110, 198
  - bicolor 211
  - brassicæ 91
  - capreæ 84
  - carduella 100
  - caryæ 116
  - caryella 170
  - cephalanthi 97, 192
  - cerasi 93
  - cerasifoliæ 93
  - cerealis 51
  - chenopodii 88
  - circæzandis 89
  - corni 101
  - cornifoliæ 101, 193
  - coryli 106

PAGE.

- Aphis.
  - craccæ 88
  - cratægi 101
  - cratægifoliæ 101, 19
  - dahliæ 88
  - dauci 181
  - diospyri 95
  - diplepha 211
  - discolor 211
  - euonymi 88
  - fabæ 88
  - fagi 120
  - fraxini 147
  - fumipennella 171
  - furcipes 211
  - galliscabri 88
  - genistæ 88
  - gibbosa 211
  - granaria 51
  - helianthi 191
  - hordei 51
  - hortensis 81
  - hyperici 193
  - humuli 87
  - impatientis 98
  - laburni 88
  - lactucæ 61
  - lanigera 126
  - lathyri 64
  - lutescens 191
  - maculella 171
  - mahaleb 70, 73
  - maidis 89
  - mali 85, 121
  - malifoliæ 86
  - marginella 171
  - marginipennis 211
  - medicaginis 101, 192
  - middletonii 99
  - nerii 95
  - onobrychis 64
  - oreaster 211
  - papaveris 88
  - pastinaceæ 84
  - pilosa 211
  - pinicolens 102
  - pisi 64
  - populi 105
  - populifoliæ 102, 151
  - pruni 72, 82, 87
  - prunifoliæ 87
  - punctatella 171
  - pyri 101
  - quercifoliæ 79
  - quercus 108
  - rhodryas 211
  - ribicola 76
  - ribis 76
  - ribis-nigri 61
  - rubecula 211
  - rumicis 88, 193
  - salicicola 192
  - salicti 115
  - sambuci 100
  - sambucifoliæ 100
  - setariæ 192
  - solidaginis 49
  - sonchi 69
  - symphoricarpi 90
  - thlaspeas 84

PAGE.
Aphis
    tulipæ 87, 188
    ulmariæ 64
    ulmi 119, 136
    vernoniæ 97
    verticolor 211
    viburni 96
    vicæ 88
    vitis 55
apocyni 94
Apple-leaf Aphis 86
Apple-tree Aphis 85
aquilegiæ 83
armata 88
Artificial means of destruction 179
asclepiadifolii 58
asclepiadis 197, 198
atriplicis 88, 191
avenae 51
avenaphis 176

B.

Balm of Gilead Plant-louse 103
Bean Aphis 88
Beautiful Oak Aphis 106
beccabunge 97
bella 106, 107, 196, 197
Beech Aphis 120
Beech Blight 130
Beech-tree Blight 139
berberidis 81, 87
betulae 14, 110
betulaecolens 110, 196, 199
betulella 110, 111, 199
bicolor 211
Birch Gay-louse 110
bivulnerus 174
Blackberry Flea louse 17
Blackberry-leaf Aphis 121
Black-legged Diraphia 14
Bottle-grass Aphis 56
Box-Elder Plant-louse 103
brassicae 91
bulbipes 108
bumeliae 148
Button-bush Aphis 97
Byrsocripta pseudobyrsa 151
    ulmicola 142, 204
    vagabunda 151
    vitifoliae 158

C.

Cabbage Plant louse 91
calamorum 14
Calamus Diraphia 14
Calaphis betulella 110, 111, 199
calendulella 186
calendulae 188
Callipterus 109, 195
    bella 196
    betulae 110
    betulaecolens 196, 198
    caryae 196, 199
    caryellus 170
    castaneæ 114
    discolor 196, 197
    fumipennella 171
    hyalinus 196, 198
    juglandis 113
    maculellus 171
    marginellus 171
    mucidus 172
    punctata 196, 198
    punctatellus 171
    quercicola 196, 199
    quercifolii 112
    quercus 113; 174
    ulmicola 111
    ulmifolii 184, 195
    walshii 195, 196

PAGE.
Canada Flea-bane Aphis 75
candicans 105
capreae 84
carduella 100
carpenterii 54
carpini 18
caryae 116
caryae-caulis 160
    -fallax 164
    -foliae 161
    -globuli 164
    -globosa 163
    -gummosa 154
    -ren 154
    -septa 164
    -venae 162
    -semen 163
caryella 170
caryellus 70
castaneae 114, 164
cephalanthi 97, 192
Ceraphron carpenterli 54
cerasaphis 176
cerasi 75, 93
cerasifoliae 93
cerealis 57
cervicalis 132
Chaitophorus 103, 200
    candicans 105
    lonicera 104
    negundinis 103
    ononedis 106
    populicola 102, 103
    quercicola 201
    salicicola 105
    smithiae 200
    viminalis 105, 200
Characteristics of the family (Aphididæ) 26
chenopodii 87
Chermes 105
    abieticolens 156
    abietis 157
    laricifoliae 1 7
    laricis 155
    pinifoliae 156
Chermesinae 154
    Synopsis of 41
Chestnut Gay-louse 114
Chilocorus bivulnerus 174
Chlorophana 178
Chrysopa oculata 177
    eriosoma 136
    illepida 178
    chlorophana 178
    ploribunda 178
    pseudographa 178
circaezandis 89
Cladobius 198
Classification of Aphiddiae 33
    by Kaltenbach 33
    " Koch 34
    " Passerini 35
    " Serville and Amyot 33
    " Walsh 37
    " Westwood 44
Coccinella munda 174
    nine-notata 174
Coccinellidae 172
Coccus mali 126
Colopha 142
    eragrostidis 154
    ulmicola 142, 144, 204
compressa 138
convergens 173
coreopsidis 59
Corn Aphis 89
    Sipha 122
corni 101
cornica 164
cornicola 141
cornifoliæ 101, 193
Coryli 106
Counterfeit Golden eye 178

PAGE.

C—Continued.

craccæ 88
cratægi 101
cratægifoliæ 101
cucurbitæ 67
cyparissæ 57

D.

Dactylosphera globosum 163
  vitifoliæ 158
dahliæ 88
dauci 181
dentatus 115, 116
depressa 164
dianthi 80
diospyri 95
diplepha 211
Diraphia 13
  calamorum 14
  femoralis 14
  maculipennis 14
  vernalis 14
dirhoda 67
Disagreeable Golden Eye 178
discolor 196, 198, 211
Dogsbane Plant-louse 94
Dogwood Aphis 101
Drepanosiphum 78
  acerifolii 195
  acerini 78
  aceris 78
  quercifolii 70
  tiliæ 188

E.

Elder Aphis 100
Elm Gay-louse 111
  -leaf Aphis 140
  -leaf Cockscomb Gall 144
Ephedrus plagiator 54
eragrostidis 144
erigeronensis 58, 100, 168
Eriophilus mali 131
Eriosoma lanigera 126
  mali 126
  pyri 128
  ulmi 136
euonymi 88
euphorbiæ 56
euphorbicola 57
External Anatomy 20
Eye marked Golden Eye 177

F.

fabæ 88
fagi 120
femoralis 14
ficus 16
fifteen punctata 174
forcata 164
Formica aphidicola 156
formicarius 150
formicetorum 150
fragariæ 68, 189
fraxini 147, 211
fraxinifolii 146, 207
fumipennela 171
fungicola 141
furcipes 211

G.

Gall Plant-lice (Pemphiginæ) 122
galliscabri 88
Garden mint Aphis 68
gei 65
Genera, List of 42
genistæ 88

PAGE.

gerardiæ 65
gibbosa 211
glacialis 174
globosum 163
Glyphina eragrostidis 144
  ulmicola 89, 142, 204
Grain Aphis 57
granaria 51
Grape inhabiting Aphis 55
  Phylloxera 158
Gray willow Aphis 116
Green Dolphin or Pea Plant louse 64

H.

Habits and Life History 27
Hamamelistes spinosus 206
helianthi 191
Hemiptera 9
  Key to 11
Heteroptera 9
heucheræ 66
Hickory Gall Aphis 160
  Leaf witherer 161
  Plant louse 116
Hippodamia convergens 173
  glacialis 174
  maculata 173
  13-punctata 174
Homoptera 9
  subdivisions of 10
Honeysuckle Plant louse 104
Hop Aphis 70
hordei 51
Hormaphis.
  spinosus 206
Hornbeam Psylla 18
hortensis 88
humuli 70, 87
hyalinus 196, 198
Hyalopterus 82
  acquilegiæ 83
  pruni 82
hyperici 108, 193

I.

Ichneumon flies 175
illepida 177, 178
imbricator 139
impatientis 98
Insect enemies and parasites 172
Introduction 5
Ironweed Aphis 97

J.

jaceæ 188
juglandis 113
Jumping Plant lice 12, 15

K.

Kaltenbach, Classification of 33
Key to Hemiptera 11
Knotweed Aphis 62
Koch, Classification of 34

L.

laburni 88
Lachninæ 114
Lachnini 114
Lachnus 115
  abietis 117, 118
  alnifoliæ 118
  caryæ 116
  dentatus 115, 116
  laricifex 117
  longistigma 119
  pini 117
  populi 119

PAGE.
L—Continued.
  quercifoliæ.... ....108, 118
  salicelis........... 119
  salicecola, ...105, 115
  strobi 117
  ulmi......... 119
lactucæ.................................. 61
lactucaphis 175
Lady-bird............................. 172
lanigera................................ 126
Larch chermes.... 156
laricifex.......... 117
laricifoliæ.......... 156
laricis............ 155
lathyri..... 64
Letter of Transmittal....... 1
Lettuce Aphis.................. 61
  Earth louse..................... 165
Life, history and habits... 27
Linden. 119
liriodendri.......... 189
List of Genera......................... 42
Livia..... 13
Livilla................................... 212
longistigma.... 119
lonicera................ 104
lutescens 191

M.

maculata....................... 173
maculella 171
maculellus 171
maculipennis.................... 14
mahaleb 70, 72
maidis 89
Maize Aphis... 122
  Sipha............. 89
mali 85
malifoliæ...... 86
malvæ 61
Margined Spurge Aphis 57
marginella 171
marginellus 171
marginipennis 211
maydis...................... 122
medicaginis............ .... 101, 192
Megoura...... 73
  solani......... 73
menthæ 68
middletonii...... 99
Milkweed Aphis............. 58
Mouldy Aphis.......................... 172
mucidus............................... 172
munda.... 174
Myzocallis 105
  bella...... 106
  hyperici............ 108
  mali......... 126
  quercicola 106
Myzoxylides............................. 123
Myzus cerasi 75
  cerasifoliæ......... 93
  persicæ.....................76, 102
  ribis........ ....50, 76

N.

negundinis... 103
Nematus salicis-pomum.... 206
nerii................................. . 95
nine-notata...... 174
Nomenclature. 19

O.

Oak-Blight... 139
  -leaf Gay louse 112
  " Lachnus..................... 118
  " Phylloxera 163
oculata.................. 177
Oleander Plant-louse... 112
onobrychis................. 64
ononedis.................................. 106
oreaster............. 211

P.

panici.................. ....138, 169
panicola...............................5, 138
papaveris 88
Parsnip Plant-louse.. 84
Pastinaciæ........................... 84
Pea Plant-louse 61
Peach tree Aphis 76
Pear-tree Jumping Plant louse........ 16
Pemphiginæ... .... 41, 122, 145
Pemphigini............... .. .... 124, 125, 145
Pemphigus 146
  acerifolii.... 209
  caryæcaulis 160
  caryæ-venæ 162
  formicarius...... 150
  formicetorum.... 150
  fraxini......... 211
  fraxinifolii............... 146, 210
  popularia 153
  populicaulis 149
  populi-globuli........... ... 153
    -monilis... 205
    -ramulorum.. 209
    -transversus.... 208
    -venæ 154
  pseudobyrsa.... 151
  pyri..... .... 126, 128, 150
  rhois.... 152
  rubi 147
  ulmicola.............. .. .142, 144
  ulmi-fusus................ ... 153
  vagabundus... . ... 146, 151
  vitifoliæ............ 158
Peritymbia vitisana 158
persicæ............................ . .. 76
Persimmon Plant louse... 95
Phorodon............ 69
  humuli................. 70
  mahaleb 72
  scrophularia.... 72
Phyllaphis.............................. 120
  fagi.................. 120
Phylloxera 157
  caryæcaulis.... 160
    -falax.................... 164
    -foliæ.................... 161
    -globosa.................. 163
    -globuli.................. 164
    -gummosa............... 164
    -ren............... 164
    -semen... 163
    -septa..... 164
    -venæ....... 162
  castaneæ......... 164
  cornica........ 164
  depressa.. 164
  forcata................ 164
  rileyi.... 163
  spinosa........ 164
  vastatrix.... 158
  vitifoliæ................... . . 158
pilosa.......... 211
Pine-tree Blight........ 140
pini 117
pinicola.......... 5
pinicolens 102, 151
pinifoliæ 156
Pipiza radicum........ 131
pisi 64
plagiator.... 54
Plant-lice. True......... 19
ploribunda...... 178
Plum-tree Aphis......... 87
poæ 166
polygonaphis................. 175
polygoni....... 62

P—Continued.

PAGE.
Poplar Bullet Gall-louse 152
  Gall-louse 153
  -leaf Aphis 102
  -leaf Gall louse 149
  -vein Gall-louse 153
populaphis 176
popularia 153
populi 105, 119
  -caulis 149
  -globuli 153
  -monilis 205
  -ramulorum 205
  -transversus 154
  -venæ 154
populicola 102, 103, 129
populifoliæ 102
Prociphilus bumeliæ 147
pruni 72, 82, 87
prunifoliæ 87, 156
pseudobyrsa 151
pseudographa 178
Psylla 15
  annulata 18
  carpini 18
  ficus 16
  pyri 16
  quadrilineata 18
  quadrisignata 18
  rubi 17
  tripunctata 10
  urticæcolens 18
Psyllidæ 11, 12, 211
  Brief synopsis of the genera of 212
punctata 193, 195
punctatella 171
punctatellus 171
pyri 16, 101, 136, 128

Q.

quadrilineata 18
quadrisignata 18
querci 1, 139
quercicola 106, 196, 199, 201
quercifoliæ 79, 108, 118
quercifolii 79, 112
quercus 108, 113, 194

R.

radicum 132
Red Elm Gall louse 153
Remarks 181
Rhizobinæ 165
Rhizobius 165
  lactucæ 165
  poæ 166
  sonchi 167
rhodryas 211
rhois 125
Rhopalosiphum 79
  berberidis 81
  dianthi 80
  lactucæ 62
  lonicera 104
  pastinaciæ 61
  rhois 194
  ribis 76
  salicis 194
  tulipæ 80, 188
ribicola 76
ribis 50, 76
ribis-nigra 61
rileyi 163
rosæ 50
rosarum 51
rubecula 211
rubi 17, 107
rubifoliæ 121
rubifolii 121
rudbeckiæ 49

PAGE.
rumicis 88, 193
Ryzaphis vastatrix 158

S.

salicaphis 175
salicelis 119
salicicola 105, 115, 119, 192
salicis 194
salicis-pomum 206
salicti 115
sambuci 100
sambucifoliae 100
Schizoneura 125
  americana 202, 211
  caryae 141
  compressa 139
  cornicola 141
  fagi 140
  fungicola 141, 197
  imbricator 136
  lanigera 124, 126
  panicola 138
  pinicola 137
  rileyi 136
  strobi 140
  tessellata 139
  ulmi 119, 124, 140
  venusta 137
Schizoneurinae 125
Schizoneurini 124, 125
scrophulariæ 72
Scymnus cervicalis 14
setariae 56, 120
Sipha 120
  maydis 122
  rubifolii 121
Siphocoryne 3
  capreae 84
  pastinacæ 84
Siphonophora 46
  absinthii 66
  acerifoliae 57, 195
  achyrantes 187
  ambrosiae 50
  asclepiadifolii 58
  asclepiadis 50
  avenae 51
  calendulae 190
  calendullela 188
  coreopsidis 59
  crataegi 187
  cucurbitae 67
  cyparissiae 57
  dirhoda 67
  erigeronensis 58
  euphorbiæ 56
  euphobicola 57
  fragariae 68, 191
  gerardiae 65
  gei 65
  granaria 6, 54
  heucherae 66
  jaccae 118
  lactucae 60
  lirodendri 189
  malvae 61
  menthae 68
  pisi 64
  polygoni 62
  ribicola 76
  rosae 50
  rosarum 51
  rubi 64
  rudbeckiae 49, 190
  salicicola 63, 192
  setariae 56, 192
  sonchella 189
  sonchi 189
  tanaceti 68
  tiliae 189
  tulipae 188
  ulmariae 64

S.—Continued.

PAGE.

verbenae 63
viticola 55
Siphonphorini (Section) 46
smithiae 200
Snow-ball Aphis 96
Snow-berry Aphis 99
solani 73
solidaginis 49
sonchi 60
spinosa 164
spinosus 206
Spotted Willow Aphis 116
Spruce-tree Lachuns 117
strobi 117
St Johnswort Plant-louse 108
Sumac Gall-louse 152
Supplement 185
Synopsis of the Families of Plant-lice. 10
of the Subdivisions and Genera
of Aphidinae 39
of Chermesinae 41
of Pemphiginae 41
of Rhizobinae 41
Synoptical table of the Sub-families (Aphididae) 39
Syrphus 179
fly Root-louse 131

T.

Tamarack Aphis 117
tanaceti 69
tessellata 139
Tetraneura ulmi 146
Thelaxes 142
ulmicola 142, 144, 204
thlaspeas 88
Thorn-leaf Aphis 101
tiliae 188
Touch-me-not Aphis 98
Toxares triticaphis 176
Trioxys cerasaphis 176
populaphis 176
salicaphis 176
tripunctata 18
triticaphis 176
Trombidium bulbipes 108
tulipae 80
Tychea 138
erigeronensis 100
panici 138

U.

PAGE.

ulmariae 64
ulmi 119, 136, 140, 146
ulmicola 89, 111. 142, 144. 204
ulmifolii 195, 89C
ulmi-fusus 153
urticaecolens 18

V.

Vacuna 142, 145
Vacunini 124
Vagabond Gall-louse 151
vagabunda 15
vagabundus 146, 151
vastatrix 158
venusta 139
verbenae 63
vernalis 14
vernoniae 97
verticolor 211
viburnaphis 175
viburni 96
vicae ....
viminalis 105, 200
viticola 105
vitifoliae 158
vitis 55
vitisana 158

W.

walshii 196, 197
Weeping Golden-eye 179
White Pine Lachnus 117
Willow Plant-louse 115
Wooly Aphis of the Apple-tree 126
natural enimies of 131
Remedies for 132
Wooly Aphis of the Elm-tree 136
of the Oak 139
Wooly Plant-lice (Schizoneura) 125

X.

Xanthelis 211

Y.

Yellow-headed Golded-eye 178

ERRATA.

Page 9, for HEMOPTERA read HEMIPTERA.
Page 11, for HEMOPTERA read HEMIPTERA.

[illegible] U. OF I. URBANA-CHAMPAIGN

LIBRARY U. OF I. URBANA-CHAMPAIGN

BOUND BY
HNM

UNIVERSITY OF ILLINOIS-URBANA
3 0112 018135837